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Improvement in Road Steamers.

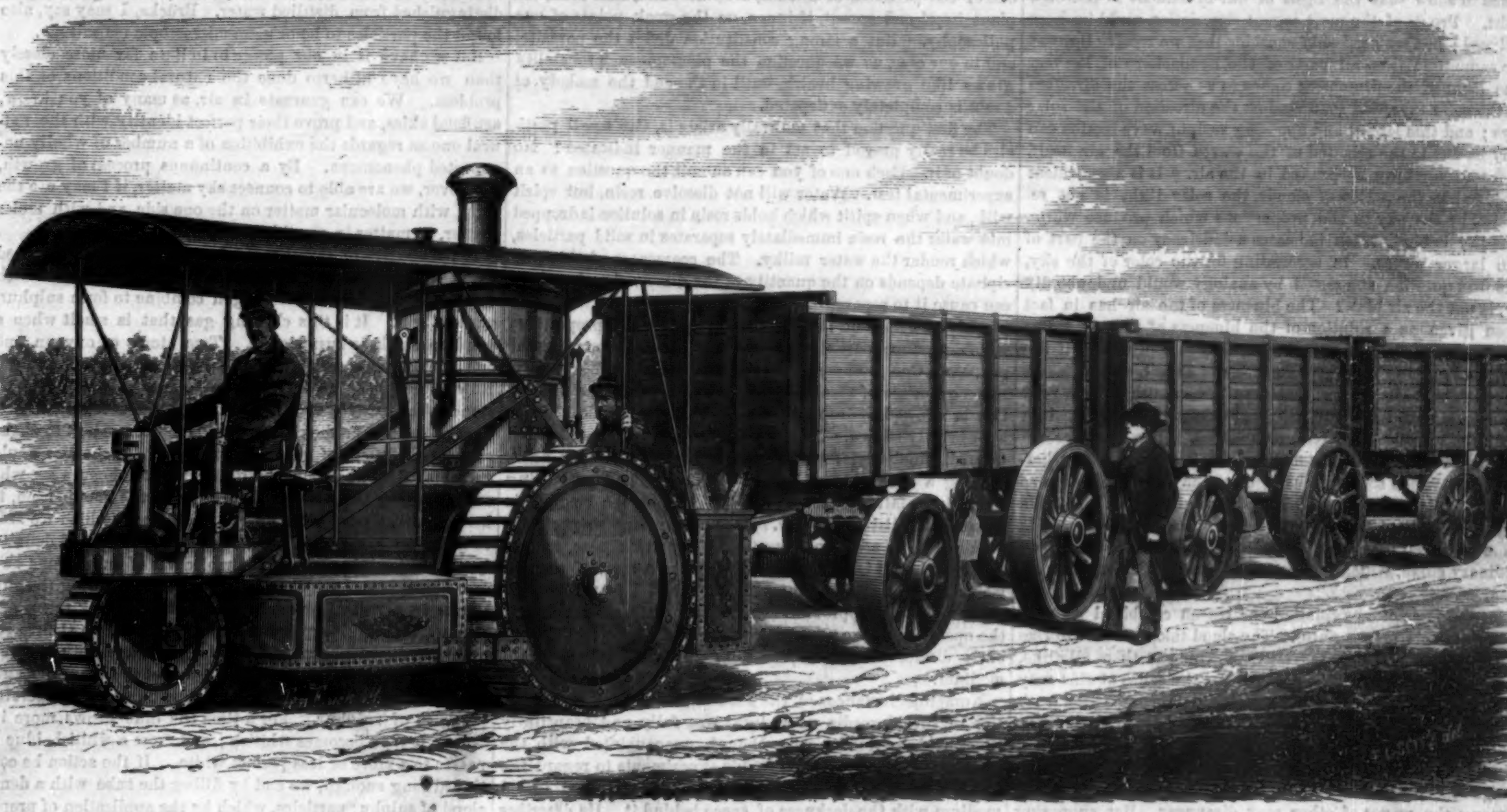
This remarkable traction engine has, during the past two years, attracted more notice among scientific men than any of the numerous road locomotives which have ever preceded it. The use of steam on common roads has long excited the great interest of all engineers as well as of those who would benefit by its practical introduction. Without discussing the special reasons of the failure of the Boydell system, with its cumbrous self-carrying tramway, or the Bray engine with its projecting and receding claws operating through the periphery of its driving wheels, it may be briefly stated that no road engine has ever satisfied the demand for driving heavy trains of wagons on common roads, until the advent of Mr. Thomson's ingenious invention, which is illustrated on this page.

Adhesion, without too great weight; traction, without destroying the roads; gearing, which would not break when jolting over rough pavements, and steerage which would enable the engine to be easily turned, were some of the absolute requirements of a practical road locomotive. The enormous weight of the traction engines, with rigid tires, now used in connection with steam plowing in England, proves its necessity for the purpose of gaining sufficient adhesion. Their provision for inserting teeth in the face of the wheels tells the story of their destruction of roads when drawing heavy loads. Their inability to use springs causes a wear and tear of gearing and working parts, which any mechanic will understand, and the time consumed in turning corners quite unfits them for high speed.

Many ingenious traction engines have been made in this country, but as they were not constructed for drawing heavy loads, there was no occasion for them to surmount the difficulties stated above.

In the elastic tire invented by R. W. Thomson, C. E., of Edinburgh, all these fatal objections have been overcome and new powers developed. The idea of using vulcanized rubber for gaining adhesion, traction, and simplicity of gearing, was as novel as valuable. Even this useful and important discovery might have never been given to the world had not Mr. Thomson been a gentleman of large means as well as a thoroughly educated engineer. He was thus enabled to continue his experiments and perfect his invention before it was brought before the public, and it is probably for this reason that it at once attracted the notice of the most eminent engineers of the Old and the New World.

A brief description of the "Road Steamer" is all that is necessary in connection with the accompanying engraving. The driving wheels are about five feet in diameter with a broad iron tire having narrow flanges, upon which is placed a ring of soft vulcanized rubber twelve inches in width and five inches in thickness, which surrounds the iron tire, and is kept in place by the flanges. Over the rubber there is placed an endless chain of steel plates, three and a half inches wide, which series of plates is the portion of the wheel which comes in contact with the rough road. This reticulated chain is connected by what might be properly styled steel vertebræ, at each side of the wheel. The rubber tire and this ring of steel plates, have no rigid connection, but are at perfect liberty to move round independently of each other, or even without the concurrence of the inner ring of the wheel which they both inclose. This is a remarkable combination and contributes to the great success of the wheel as a whole. Holes are made in the inner iron rim of the wheel to admit air under the rubber tire. This enables the rubber to slowly creep round the wheel, so that in going a mile with a heavy load in tow, the rubber tire will be found to have crept once around the iron tire. To this ingenious device is due the indestructible nature of the tire. An enormously sudden and heavy strain upon the soft tire might tear it, but the slight slip saves it. Nearly the whole weight of the engine is upon the drivers, the third wheel in front being only for steering. The steering apparatus is therefore exceedingly simple, and the rapidity and ease with which it guides the steamer must be seen to be properly realized. It will instantly spin around with its inner driving wheel, describing a circle of less than six feet in diameter. The weight upon the rubber tires causes them to collapse and conform to all the irregularities of the road for a space of twenty inches each, and thus is insured adhesion and traction, which cannot be obtained in the slight line of contact with smooth rigid tires. To this fact is due the ability of the road steamer to draw enormous loads and to ascend steep hills.



THOMSON'S PATENT ROAD STEAMER.

Perhaps one of its most important features, as concerns its use in this country, is its ability to run over soft ground or muddy roads. The rigid-tired traction engines in England are able to slowly grind over their hard and magnificently macadamized roads, but upon our common dirt roads they would be utterly useless. In this respect the road steamer has been not inaptly compared to the elephant and camel, whose elastic cushioned feet enable them to cross the soft yielding sands of the desert. It is this same elastic cushion which prevents injury to the roads, and which, acting as springs or buffers between the rough road and the gearing saves the machinery from damage. The work done by the wheel in depressing the rubber in front, is again performed by the rubber at the rear in urging the wheel forward, so that the one exactly balances the other, hence there is no loss.

The boiler used is of the vertical tubular type made entirely of steel and constructed with special regard to simplicity and great strength. All the gearing and working parts are either of steel or malleable iron, and are entirely hidden from sight. An ingenious device in connection with the exhaust steam almost completely suppresses the noise caused by its escape. The coal bunkers hold a day's supply, and the water tanks hold a third of a day's supply. There is a single gear for quick speed, and a double gear for heavy loads. The engines are double cylinders with a reversing gear. Either of the driving wheels can be thrown in or out of gear, so that in turning sharp corners the inner wheel is out of gear, slipping freely while the outer wheel drives the machine around.

When attached to a loaded train of four wagons by a simple triangle coupling the whole can be turned in any road of ordinary width, each wagon following in the exact wake of the steamer. The loads drawn by the two sizes now made are from twelve to twenty tuns, up inclines of one in twelve, and twenty to thirty tuns on an ordinary level road. The speed varies from two and a half to six miles per hour for freight steamers, and ten miles per hour if constructed specially for passenger service. The consumption of coal averages about half a tun per day. About three times as much wood by weight is required to furnish the same steam power.

All the road steamers can be fitted with a fly wheel and governor, so as to run as stationary engines for driving any description of machinery.

The British Government appointed a commission of military men to examine these road steamers with the view of adopting them in the War Department. The examination was most severe and the report so favorable that a number have been ordered; among others one to carry stores up the Rock of Gibraltar, the inclines being one in six. Various other European governments have, after careful examination, ordered them for drawing heavy artillery and for other purposes. Over seventy road steamers are now in order at the works in Great Britain for India, Australia, and other countries.

With our vast country so much of which must be for many years without railroads they will be of great use for mines, transportation companies, feeders to railroads, for general carrying purposes, and for towing on canals. One steamer can draw six boats at double the speed of horses. And lastly, in plowing the grain fields of the Great West, as also the sugar and cotton plantations of the South, they will find a wide field of usefulness, and prove of great value. Harnessed to one of Williamson's gang plows they turn seven furrows of eight inches depth and twelve inches width with perfect ease, as we can testify, having personally witnessed the performance of one of them, not long since, in plowing obstinate soil.

Mr. D. D. Williamson, of 32 Broadway, New York, is the exclusive manufacturer under Mr. Thomson's American patents. No better assurance can be given that the American engines will be fully equal if not superior to the British, than the fact that the Grant Locomotive Works, of Paterson, whose locomotive at the great Paris Exhibition took the prize over all others, have contracted to build them for Mr. Williamson, and are now constructing a number for the American market.

SCIENTIFIC USE OF THE IMAGINATION.

John Tyndall, LL.D., F.R.S., before the British Association.

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Not only are the waves of ether reflected by clouds, by solids, and by liquids, but when they pass from light air to dense, or from dense air to light, a portion of the wave-motion is always reflected. Now our atmosphere changes continually in density from top to bottom. It will help our conceptions if we regard it as made up of a series of thin concentric layers or shells of air, each shell being of the same density throughout, and a small and sudden change of density occurring in passing from shell to shell. Light would be reflected at the limiting surfaces of all these shells, and their action would be practically the same as that of the real atmosphere.

And now I would ask your imagination to picture this act of reflection. What must become of the reflected light? The atmospheric layers turn their convex surfaces towards the sun; they are so many convex mirrors of feeble power, and you will immediately perceive that the light regularly reflected from these surfaces cannot reach the earth at all, but is dispersed in space.

But though the sun's light is not reflected in this fashion from the aerial layers to the earth, there is indubitable evidence to show that the light of our firmament is reflected light. Proofs of the most cogent description could be here adduced; but we need only consider that we receive light at the same time from all parts of the hemisphere of heaven. The light of the firmament comes to us across the direction of the solar rays, and even against the direction of the solar rays; and this lateral and opposing rush of wave-motion can only be due to the rebound of the waves from the air itself, or from something suspended in the air. It is also evident that, unlike the action of clouds, the solar light is not reflected by the sky in the proportions which produce white. The sky is blue, which indicates a deficiency on the part of the larger waves. In accounting for the color of the sky, the first question suggested by analogy would undoubtedly be, is not the air blue? The blueness of the air has in fact been given as a solution of the blueness of the sky. But reason basing itself on observation asks in reply, How, if the air be blue, can the light of sunrise and sunset, which travels through vast distances of air, be yellow, orange, or even red? The passage of the white solar light through a blue medium could by no possibility redden the light. The hypothesis of a blue air is therefore untenable. In fact, the agent, whatever it is, which sends us the light of the sky, exercises in so doing a dichroitic action. The light reflected is blue, the light transmitted is orange or red. A marked distinction is thus exhibited between the matter of the sky and that of an ordinary cloud, which latter exercises no such dichroitic action.

By the force of imagination and reason combined we may penetrate this mystery also. The cloud takes no note of size on the part of the waves of ether, but reflects them all alike. It exercises no selective action. Now the cause of this may be that the cloud particles are so large in comparison with the size of the waves of ether as to reflect them all indifferently. A broad cliff reflects an Atlantic roller as easily as a ripple produced by a sea bird's wing; and in the presence of large reflecting surfaces the existing differences of magnitude among the waves of ether may disappear. But supposing the reflecting particles, instead of being very large, to be very small, in comparison with the size of the waves. In this case, instead of the whole wave being fronted and in great part thrown back, a small portion only is shivered off. The great mass of the wave passes over such a particle without reflection. Scatter then a handful of such minute foreign particles in our atmosphere, and set imagination to watch their action upon the solar waves. Waves of all sizes impinge upon the particles, and you see at every collision a portion of the impinging wave struck off by reflection. All the waves of the spectrum, from the extreme red to the extreme violet, are thus acted upon. But in what proportions will the waves be scattered? A clear picture will enable us to anticipate the experimental answer. Remembering that the red waves are to the blue much in the relation of billows to ripples, let us consider whether those extremely small particles are competent to scatter all the waves in the same proportion. If they be not—and a little reflection will make it clear to you that they are not—the production of color must be an incident of the scattering. Largeness is a thing of relation; and the smaller the wave the greater is the relative size of any particle on which the wave impinges, and the greater also the ratio of the reflected portion to the total wave.

A pebble placed in the way of the ring-ripples produced by our heavy rain-drops on a tranquil pond will throw back a large fraction of the ripple incident upon it, while the fractional part of a larger wave thrown back by the same pebble might be infinitesimal. Now we have already made it clear to our minds that to preserve the solar light white its constituent proportions must not be altered; but in the act of division performed by these very small particles we see that the proportions *are* altered; an undue fraction of the smaller waves is scattered by the particles, and, as a consequence, in the scattered light blue will be the predominant color. The other colors of the spectrum must, to some extent, be associated with the blue. They are not absent but deficient. We ought, in fact, to have them all, but in diminishing proportions, from the violet to the red.

We have here presented a case to the imagination, and, assuming the undulatory theory to be a reality, we have, I think, fairly reasoned our way to the conclusion that, were particles, small in comparison to the size of the ether waves, sown in our atmosphere, the light scattered by those particles would be exactly such as we observe in our azure skies. When this light is analyzed all the colors of the spectrum are found; but they are found in the proportions indicated by our conclusion.

Let us now turn our attention to the light which passes unscattered among the particles. How must it be finally affected? By its successive collisions with the particles the white light is more and more robbed of its shorter waves; it therefore loses more and more of its due proportion of blue. The result may be anticipated. The transmitted light, where short distances are involved, will appear yellowish. But as the sun sinks towards the horizon the atmospheric distances increase, and consequently the number of the scattering particles. They abstract in succession the violet, the indigo, the blue, and even disturb the proportions of green. The transmitted light under such circumstances must pass from yellow through orange to red. This also is exactly what we find in nature. Thus, while the reflected light gives us at noon the deep azure of the Alpine skies, the transmitted light gives us at sunset the warm crimson of the Alpine snows. The phenomena certainly occur *as if* our atmosphere were a medium rendered slightly turbid by the mechanical suspension of exceedingly small foreign particles.

Here, as before, we encounter our sceptical "as if." It is one of the parasites of science, ever at hand, and ready to plant itself and sprout, if it can, on the weak points of our philosophy. But a strong constitution defies the parasite, and in our case, as we question the phenomena, probability grows like growing health, until in the end the malady of doubt is completely extirpated.

The first question that naturally arises is, Can small particles be really proved to act in the manner indicated? No doubt of it. Each one of you can submit the question to an experimental test. Water will not dissolve resin, but spirit will, and when spirit which holds resin in solution is dropped into water the resin immediately separates in solid particles, which render the water milky. The coarseness of this precipitate depends on the quantity of the dissolved resin. You can cause it to separate in thick clots or in exceedingly fine particles. Professor Brücke has given us the proportions which produce particles particularly suited to our present purpose. One gramme of clean mastic is dissolved in eighty-seven grammes of absolute alcohol, and the transparent solution is allowed to drop into a beaker containing clear water kept briskly stirred. An exceedingly fine precipitate is thus formed, which declares its presence by its action upon light. Placing a dark surface behind the beaker, and permitting the light to fall into it from the top or front, the medium is seen to be distinctly blue. It is not perhaps so perfect a blue as I have seen on exceptional days, this year, among the Alps, but it is a very fair sky blue. A trace of soap in water gives a tint of blue. London, and I fear Liverpool milk, makes an approximation to the same color through the operation of the same cause; and Helmholtz has irreverently disclosed the fact that a blue eye is simply a turbid medium.

Numerous instances of the kind might be cited. The action of turbid media upon light was fully and beautifully illustrated by Goethe, who, though unacquainted with the undulatory theory, was led by his experiments to regard the blue of the firmament as caused by an illuminated turbid medium with the darkness of space behind it. He describes glasses showing a bright yellow by transmitted, and a beautiful blue by reflected light. Professor Stokes, who was probably the first to discern the real nature of the action of small particles on the waves of ether, describes a glass of a similar kind. What artists call "chill" is no doubt an effect of this description. Through the action of minute particles, the browns of a picture often present the appearance of the bloom of a plum. By rubbing the varnish with a silk handkerchief optical continuity is established and the chill disappears.

Some years ago I witnessed Mr. Hirst experimenting at Zermatt on the turbid water of the Visp, which was charged with the finely divided matter ground down by the glaciers. When kept still for a day or so the grosser matter sank, but the finer matter remained suspended, and gave a distinctly blue tinge to the water. No doubt the blueness of certain Alpine lakes is in part due to this cause. Professor Roscoe has noticed several striking cases of a similar kind. In a very remarkable paper the late Principal Forbes showed that steam issuing from the safety valve of a locomotive, when favorably observed, exhibits at a certain stage of its condensation the colors of the sky. It is blue by reflected light, and orange or red by transmitted light. The effect, as pointed out by Goethe, is to some extent exhibited by peat smoke.

More than ten years ago I amused myself at Killarney by observing on a calm day the straight smoke columns rising from the chimneys of the cabins. It was easy to project the lower portion of a column against a dark pine, and its upper portion against a bright cloud. The smoke in the former case was blue, being seen mainly by reflected light; in the latter case it was reddish, being seen mainly by transmitted light. Such smoke was not in exactly the condition to give us the glow of the Alps, but it was a step in this direction. Brücke's fine precipitate above referred to looks yellowish by transmitted light, but by duly strengthening the precipitate you may render the white light of noon as ruby colored as the sun when seen through Liverpool smoke or upon Alpine horizons.

I do not, however, point to the gross smoke arising from coal as an illustration of the action of small particles, because such smoke soon absorbs and destroys the waves of blue instead of sending them to the eyes of the observer.

These multifarious facts, and numberless others which cannot now be referred to, are explained by reference to the single principle that where the scattering particles are small in comparison to the size of the waves we have in the reflected light a greater proportion of the smaller waves, and in the transmitted light a greater proportion of the larger waves, than existed in the original white light. The physiological consequence is that in the one light blue is predominant, and in the other light orange or red. And now let us push our inquiries forward. Our best microscopes can readily reveal objects not more than $\frac{1}{50000}$ of an inch in diameter. This is less than the length of a wave of red light. Indeed a first-rate microscope would enable us to discern objects not exceeding in diameter the length of the smallest waves of the visible spectrum. By the microscope, therefore, we can submit our particles to an experimental test. If they are as large as the light-waves they will infallibly be seen; and if they are not seen it is because they are smaller.

I placed in the hands of our president a bottle containing Brücke's particles in greater number and coarseness than those examined by Brücke himself. The liquid was a milky blue, and Mr. Huxley applied to it his highest microscopic power. He satisfied me at the time that had particles of even $\frac{1}{1000000}$ of an inch in diameter existed in the liquid they could not have escaped detection. But no particles were seen. Under the microscope the turbid liquid was not to be distinguished from distilled water. Brücke, I may say, also found the particles to be of ultra microscopic magnitude.

But we have it in our power to imitate far more closely than we have hitherto done the natural conditions of this problem. We can generate in air, as many of you know, artificial skies, and prove their perfect identity with the natural one as regards the exhibition of a number of wholly unexpected phenomena. By a continuous process of growth, moreover, we are able to connect sky matter, if I may use the term, with molecular matter on the one side, and with molar matter, or matter in sensible masses, on the other.

In illustration of this, I will take an experiment described by M. Morren, of Marseilles, at the last meeting of the British Association. Sulphur and oxygen combine to form sulphurous acid gas. It is this choking gas that is smelt when a sulphur match is burnt in air. Two atoms of oxygen and one of sulphur constitute the molecule of sulphurous acid. Now it has been recently shown in a great number of instances that waves of ether issuing from a strong source, such as the sun or the electric light, are competent to shake asunder the atoms of gaseous molecules. A chemist would call this "decomposition" by light; but it behooves us, who are examining the power and function of the imagination, to keep constantly before us the physical images which we hold to underlie our terms. Therefore I say, sharply and definitely, that the components of the molecules of sulphurous acid are shaken asunder by the ether waves. Inclosing the substance in a suitable vessel, placing it in a dark room, and sending through it a powerful beam of light, we at first see nothing; the vessel containing the gas is as empty as a vacuum. Soon, however, along the track of the beam a beautiful sky-blue color is observed, which is due to the liberated particles of sulphur. For a time the blue grows more intense; it then becomes whitish; and from a whitish blue it passes to a more or less perfect white. If the action be continued long enough, we end by filling the tube with a dense cloud of sulphur particles, which by the application of proper means may be rendered visible.

Here, then, our ether waves untie the bond of chemical affinity, and liberate a body—sulphur—which at ordinary temperatures is a solid, and which therefore soon becomes an object of the senses. We have first of all the free atoms of sulphur, which are both invisible and incompetent to stir the retina sensibly with scattered light. But these atoms gradually coalesce and form particles, which grow larger by continual accretion until after a minute or two they appear as sky matter. In this condition they are invisible themselves, but competent to send an amount of wave motion to the retina sufficient to produce the firmamental blue. The particles continue, or may be caused to continue, in this condition for a considerable time, during which no microscope can cope with them. But they continually grow larger, and pass by insensible gradations into the state of *cloud*, when they can no longer elude the armed eye. Thus without solution of continuity we start with matter in the molecule, and end with matter in the mass, sky matter being the middle term of the series of transformations.

Instead of sulphurous acid we might choose from a dozen other substances, and produce the same effect with any of them. In the case of some—probably in the case of all—it is possible to preserve matter in the skyey condition for fifteen or twenty minutes under the continual operation of the light. During these fifteen or twenty minutes the particles are constantly growing larger, without ever exceeding the size requisite to the production of the celestial blue. Now when two vessels are placed before you, each containing sky matter, it is possible to state with great distinctness which vessel contains the largest particles.

The eye is very sensitive to differences of light, when, as here, the eye is in comparative darkness, and when the quantities of wave motion thrown against the retina are small. The larger particles declare themselves by the greater whiteness of their scattered light. Call now to mind the observation, or effort at observation, made by our president when he failed to distinguish the particles of resin in Brücke's medium, and when you have done so follow me. I permitted a beam of light to act upon a certain vapor. In two minutes the azure appeared, but at the end of fifteen minutes it had not ceased to be azure. After fifteen minutes, for example, its color and some other phenomena pronounced it to be a

blue of distinctly smaller particles than those sought for in vain by Mr. Huxley. These particles, as already stated, must have been less than $\frac{1}{100000}$ of an inch in diameter.

And now I want you to submit to your imagination the following question: Here are particles which have been growing continually for fifteen minutes, and at the end of that time are demonstrably smaller than those which defied the microscope of Mr. Huxley. What must have been the size of these particles at the beginning of their growth? What notion can you form of the magnitude of such particles? As the distances of stellar space give us simply a bewildering sense of vastness without leaving any distinct impression on the mind, so the magnitudes with which we have here to do impress us with a bewildering sense of smallness. We are dealing with infinitesimals compared with which the test objects of the microscope are literally immense.

From their perviousness to stellar light, and other considerations, Sir John Herschel drew some startling conclusions regarding the density and weight of comets. You know that these extraordinary and mysterious bodies sometimes throw out tails 100,000,000 of miles in length, and 50,000 miles in diameter. The diameter of our earth is 8,000 miles. Both it and the sky, and a good portion of space beyond the sky, would certainly be included in a sphere 10,000 miles across. Let us fill this sphere with cometary matter, and make it our unit of measure. An easy calculation informs us that to produce a comet's tail of the size just mentioned about 300,000 such measures would have to be emptied into space. Now suppose the whole of this stuff to be swept together, and suitably compressed, what do you suppose its volume would be? Sir John Herschel would probably tell you that the whole mass might be carted away at a single effort by one of your dray-horses. In fact, I do not know that he would require more than a small fraction of a horse-power to remove the cometary dust. After this you will hardly regard as monstrous a notion I have sometimes entertained concerning the quantity of matter in our sky. Suppose a shell, then, to surround the earth at a hight above the surface which would place it beyond the grosser matter that hangs in the lower regions of the air—say at the hight of the Matterhorn or Mont Blanc. Outside this shell we have the deep blue firmament. Let the atmospheric space beyond the shell be swept clean, and let the sky matter be properly gathered up. What is its probable amount? I have sometimes thought that a lady's portmanteau would contain it all. I have thought that even a gentleman's portmanteau—possibly his snuff-box—might take it in. And whether the actual sky be capable of this amount of condensation or not, I entertain no doubt that a sky quite as vast as ours, and as good in appearance, could be formed from a quantity of matter which might be held in the hollow of the hand.

Small in mass, the vastness in point of number of the particles of our sky may be inferred from the continuity of its light. It is not in broken patches nor at scattered points that the heavenly azure is revealed. To the observer on the summit of Mont Blanc the blue is as uniform and coherent as if it formed the surface of the most close-grained solid. A marble dome would not exhibit a stricter continuity. And Mr. Glaisher will inform you that if our hypothetical shell were lifted to twice the hight of Mont Blanc above the earth's surface, we should still have the azure overhead. Everywhere through the atmosphere those sky particles are strewn. They fill the Alpine valleys, spreading like a delicate gauze in front of the slopes of pine. They sometimes so swathe the peaks with light as to abolish their definition. This year I have seen the Weisshorn thus dissolved in opalescent air.

By proper instruments the glare thrown from the sky particles against the retina may be quenched, and then the mountain which it obliterated starts into sudden definition. Its extinction in front of a dark mountain resembles exactly the withdrawal of a veil. It is the light then taking possession of the eye, and not the particles acting as opaque bodies, that interfere with the definition.

By day this light quenches the stars; even by moonlight it is able to exclude from vision all stars between the fifth and the eleventh magnitude. It may be likened to a noise, and the stellar radiance to a whisper drowned by the noise. What is the nature of the particles which shed this light? On points of controversy I will not here enter, but I may say that De la Rive ascribes the haze of the Alps in fine weather to floating organic germs. Now the possible existence of germs in such profusion has been held up as an absurdity. It has been affirmed that they would darken the air, and on the assumed impossibility of their existence in the requisite numbers, without invasion of the solar light, a powerful argument has been based by believers in spontaneous generation.

Similar arguments have been used by the opponents of the germ theory of epidemic disease, and both parties have triumphantly challenged an appeal to the microscope and the chemist's balance to decide the question. Without committing myself in the least to De la Rive's notion, without offering any objection here to the doctrine of spontaneous generation, without expressing any adherence to the germ theory of disease, I would simply draw attention to the fact that in the atmosphere we have particles which defy both the microscope and the balance, which do not darken the air, and which exist, nevertheless, in multitudes sufficient to reduce to insignificance the Israelitish hyperbole regarding the sands upon the seashore.

The varying judgments of men on these and other questions may perhaps be, to some extent, accounted for by that doctrine of relativity which plays so important a part in philosophy. This doctrine affirms that the impressions made upon us by any circumstance, or combination of circumstances, depends upon our previous state. Two travelers upon the same peak, the one having ascended to it from the plain, the other having descended to it from a higher elevation, will be differently affected by the scene around them. To the one nature is expanding, to the other it is contracting, and feelings are sure to differ which have two such different antecedent states.

In our scientific judgments the law of relativity may also play an important part. To two men, one educated in the school of the senses, who has mainly occupied himself with observation, and the other educated in the school of imagination as well, and exercised in the conception of atoms and molecules to which we have so frequently referred, a bit of matter, say $\frac{1}{50000}$ of an inch in diameter, will present itself differently. The one descends to it from his molar hights, the other climbs to it from his molecular lowlands. To the one it appears small, to the other large. So also as regards the appreciation of the most minute forms of life revealed by the microscope. To one of these men they naturally appear conterminous with the ultimate particles of matter, and he readily figures the molecules from which they directly spring; with him there is but a step from the atom to the organism. The other discerns numberless organic gradations between both. Compared with his atoms, the smallest vibrios and bacteria of the microscopic field are as behemoth and leviathan.

The law of relativity may to some extent explain the different attitudes of these two men with regard to the question of spontaneous generation. An amount of evidence which satisfies the one entirely fails to satisfy the other; and while to the one the last bold defense and startling expansion of the doctrine will appear perfectly conclusive, to the other it will present itself as imposing a profitless labor of demolition on subsequent investigators. The proper and possible attitude of these two men is that each of them should work as if it were his aim and object to establish the view entertained by the other.

(To be continued.)

PROFESSOR TYNDALL'S LECTURE ON ELECTRICAL PHENOMENA.

MAGNETO-ELECTRIC MACHINES.—SAXTON'S MACHINE.—SIEMENS' ARMATURE.

Faraday's discovery of magneto-electricity was announced in 1831. In 1833 a machine was constructed by Saxton for the more copious development of magneto-electric currents.

In it copper-wire coils, within which were placed cores of iron, were caused to rotate before the poles of a powerful magnet.

On the approach of a coil to one of the poles of the magnet, a powerful current, whose direction depended on the nature of the pole, was induced in the coil. When the coil retreated from the magnetic pole, a current in the opposite direction was induced.

By means of an instrument called a *commutator*, which reversed one of the induced currents at the proper moment, the opposite currents were caused to flow in the same direction.

The cores of soft iron and their associated coils constitute what is called an *armature*. In Saxton's armature the coils were wound *transversely* to the iron cores.

But, by winding his coils *longitudinally*, or parallel to the axis of the core, and placing the armature so formed between the poles of a series of horse-shoe magnets, Siemens obtained magneto-electic currents much more powerful than those of Saxton.

WILDE'S MACHINE.

Things were in this state when, in 1866, Wilde made an important addition to our knowledge of magneto-electricity.

He conducted the current obtained by means of Siemens' armature round an electro-magnet, and found that the magnetism thus excited was far greater than that of the entire series of steel magnets employed to generate the magneto-electric current.

Thus, in one case, he found that, whereas the series of permanent magnets taken collectively was competent to support a weight of 40 pounds only, the electro-magnet which they excited sustained a weight of 1,088 pounds.

To produce this effect, however, it was necessary that the armature of the magneto-electric machine should rotate with great rapidity.

But Wilde went farther. Forming his electro-magnet from a large plate of iron, and placing between its long poles a correspondingly long armature, similar in shape and construction to that of the magneto-electric machine, he obtained from this second armature currents of enormously greater power than those obtainable from the first.

These currents could in their turn, be sent round a second electro-magnet, formed from a larger plate of iron. Furnished with a rotating armature, this second electro-magnet produced effects previously unknown. Rods of iron a quarter of an inch in thickness were fused by the currents, and they were also found competent, when discharged between carbon terminals, to produce a light of intolerable brilliancy.

SIEMENS' AND WHEATSTONE'S MACHINE.

The next great step in magneto-electricity was made simultaneously by Dr. Werner Siemens and Sir Charles Wheatstone.

Expressed generally, this discovery consists in exalting, by means of its own action, to a high pitch of intensity an infinitesimal amount of magnetism.

Conceive an electro-magnetic core with a very small amount of residual magnetism, which is never wholly absent when iron has been once magnetized. Let a secondary coil, with cores of soft iron, rotate before the poles of such a magnet. Exceedingly feeble induced currents will circulate in the secondary coil. Let these induced currents, instead of being carried away, be sent round the electro-magnet which produced them; its magnetism will be thereby exalted. It is then in a condition to produce still stronger currents. These also being sent round the magnet, raise its magnetism still higher, a more copious production of induced currents being the consequence. Thus, by a series of interactions between the electro-magnet and the secondary helix, each in turn exalting the other, the electro-magnet is raised from a state of almost perfect neutrality to one of intense magnetization.

When the magnet has been raised to this condition, other coils than those employed to magnetize it may be caused to rotate before, or between, its poles; the currents from these coils may be carried away and made use of for magnetization, for chemical decomposition, or for the electric light.

The first magneto-electric machine used to produce a light sufficiently intense for lighthouses was constructed by Mr. Holmes. In it permanent steel magnets and rotating helices were employed. Mr. Holmes has lately constructed a very powerful machine on the principle of Siemens and Wheatstone.

INDUCED CURRENTS OF THE LEYDEN BATTERY.

If a Leyden jar, or battery, be discharged through a primary spiral, it evokes a current in a secondary spiral. With a strong charge this secondary current may be caused to deflagrate a foot of thin platinum wire.

If the current from the secondary spiral be led round a third spiral which faces a fourth, on discharging the battery through the primary spiral, the secondary in the third spiral acts the part of a primary, and evokes in the fourth spiral a *tertiary current*.

With another pair of spirals this tertiary current can be made to generate a current of the *fourth order*; this, again, with another pair of spirals, a current of the *fifth order*. All these currents can impart shocks, ignite gunpowder, or deflagrate wires.

For the investigation of the induced currents of the Leyden battery we are indebted to Professor Joseph Henry, Director of the Smithsonian Institution, and to Professor Riess, of Berlin.—*Chemical News.*

To Telegraph Learners.

A great many persons are now learning to telegraph. There will be many more in the years yet to come. A large number of men and women, in addition to the fifty per annum who die, will be over leaving the business; the former, to engage in new pursuits; the latter, to marriage and the care of households; thus leaving spaces to be filled by fresh recruits. It is interesting, therefore, to many, to know how to learn easiest and most rapidly. Many excellent plans have been proposed, among which we recall those of Prof. Smith and Mr. Pope, and Mr. Little. We propose to add our own, or rather, to state how we acquired the language. It may help some one to know how that was done.

We were first ordered to telegraph service Sept. 14, 1845 We had, at that time, never seen a telegraph register, or key, But we had given to us a copy of Vail's pamphlet, in which was the Morse alphabet. That alphabet, we at once decided, had to be learned thoroughly. Immediately, therefore, we commenced, what to us was very solemn and mysterious work, thumping out the dots and dashes on the table, with every finger of the five hugging its neighbor, and using this quintuple digit as an electric hammer. And we got on nicely. At night, we kept up the practice on the bed post, until the stars began to fade. On the cars, we drummed it out on the window pane, or on the back of the seat before us, to the wonderment of those who sat thereon. But none of these plans fixed the characters so thoroughly in mind as a practice we adopted, of writing letters to friends in the telegraphic idiom. In a very short time, by this telegraphic correspondence, we got such hold of the language that the letters soon came instinctively to us, as they must always come before any one can ever do telegraphic service worth the name. It is an easy and pleasant way to learn; an hour in the evening may thus be spent as a pastime—passing notes to companions at the table, and receiving replies. The memory will speedily become so charged with every letter that, when the fingers come to touch the key its chief difficulty will be gone, and the learner will carry to the key the same exactitude which was found necessary to execute intelligibly the letters on paper. So true was this in our own case, that, on reaching Washington, and being placed at an instrument for the first time, we at once wrote out these very euphonious lines without hesitation:

"Butcher's meat has riz,
People say it will be rizzer,
But 'tiz as 'tis,
And it can't be no 'tizzer."

And we did it about as well as ever we have done it since. We had the reputation also, for some years, of writing symmetrically. We were indebted for that to this mode of learning. Now, we have not patented the process, and all may try it who please. We think it will greatly facilitate learning at the key. When once the alphabet is thus thoroughly impressed on the memory, so that the mind has nothing to do but attend to the mechanical movement, the process of learning at the instrument is simple and readily acquired. Experience will do the rest.

Learning by sound may be acquired, after such a beginning, by as simple a method. Thus, the letter E is a single sharp click, which can be made by striking the table or plate with the edge of a cent. Two clicks make I, three make S, and so on. Now, families may learn these around the tea-table, and it may be that, in some day not far distant, the fair president of a dinner table may communicate orders to the kitchen by the Morse alphabet, or scold the juniors by a similar vernacular.—*Journal of the Telegraph.*

Improvement in Hulls of Vessels.

Our engravings illustrate a recently patented mode of constructing the hulls of vessels, which is such a radical change of form, that practical experiments with full-sized models can only prove its real value.

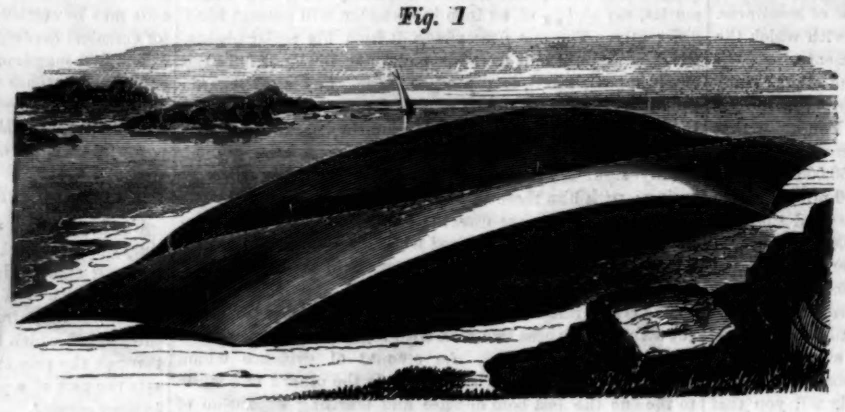
The great desideratum claimed, and which the patentee states he has demonstrated, is that the vessel is lifted above the static water line in proportion to speed attained heretofore.

Fig. 1 is a perspective view of the bottom of a vessel constructed in this manner. Fig. 2 is a plan of the same. Fig. 3 is a side plan view, and Fig. 4 is an end plan view

The object sought to be attained is to cause the water displaced by the cut-water to be gathered together convergingly under the center of the boat, and to be thence divergingly passed over at the stern in order to retain the vessel in a horizontal position, and thereby facilitate its motion through the water.

A is the center or keel line. B is the diagonal or grade line which runs from the cut-water to any given hight, and to the center of the boat or the line, D. The line, C, is produced by passing a straight edge over the lines, A and B, at a right angle with the line, A, as shown in Fig. 4. That is, if straight lines be drawn at right angles from the line, A, and also passing through the straight line, B, they will, when produced, also pass through and form points in the curved line, C.

Fig. 1



RIDER'S IMPROVED BOAT HULL.

The positions of the lines, A and B, therefore, determine all the other lines of the hull, and the modeling becomes a matter of absolute measurement, leaving nothing for the eye or judgment to do except to secure accuracy in performing the work, as indicated.

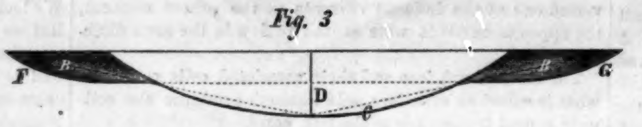
E is a central chamber commencing where the cut-water ends, where it ceases to displace the water. This chamber terminates where the counterpart of the cut-water begins to separate the volume of water from the central chamber. The opposite sides of the chamber, E, incline gradually, attaining their maximum at the center where their depth is also greatest.

The water, when the boat is in motion, is displaced by the inclined sides of the cut-water, and is converged by the reversely inclined sides of the chamber, E, until it reaches the center. The further progress of the boat brings the reversed cut-water over the united mass of fluid, which is then laterally divided, at first by a very obtuse angle or the arc of a very large circle, which gradually becomes more and more acute.

Fig. 2

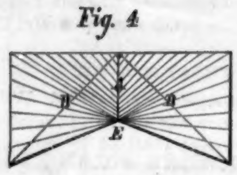
It is claimed that the converging of the volume of water displaced by the cut-water, by the gradually converging sides of the chamber, E, so as to quickly fill up the trough made by the cut-water, furnishes a firm support to the hull in the line of its center of gravity rendering it steady.

Fig. 3



It is also claimed that as an upward pressure is produced at the stern in passing over the volume of water from the chamber, E, equal to the upward pressure of the water upon the moving sides of the cut-water, there is no tendency of the boat to rise higher at the prow than at the stern, so that the boat may be urged to any practicable speed without losing its horizontal position, as is the case in boats constructed on other principles. This, it is claimed, admits of a more economical application of propelling power, as the power required to propel a boat which rises at the prow is partly expended in raising its weight up the incline thus formed.

Fig. 4



It will be seen that in this method of construction the lines are placed geometrically so as to open and close the water with equal speed, and to maintain the horizontal position, both laterally and longitudinally.

It is claimed also that the water leaves the stern of the boat as compact as when the cut-water enters it, which gives the rudder a powerful hold at high speed.

Patented, through the Scientific American Patent Agency, October 4, 1870. Address, for further information, L. P. Rider & Co., Pittsburgh, Pa.

THE STEREOSCOPE.

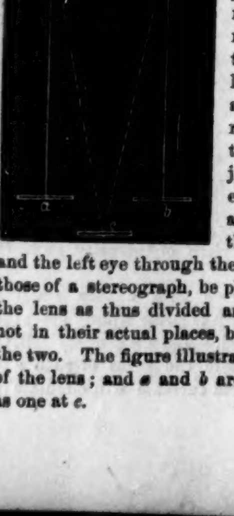
The stereoscope is comparatively a new invention, dating back only some twenty years. A form of the instrument in which mirrors were used to produce the effect was devised by Wheatstone, in 1838; but the stereoscope, as we are familiar with it, was invented by Sir David Brewster, in 1849. The former is known as the *reflecting* stereoscope, and the latter, in which lenses take the place of Wheatstone's mirrors, is called the *refracting* or *lenticular* stereoscope.

We have taken it for granted that the philosophy of the stereoscope was generally understood, but a little inquiry among our friends—including some of the better informed among them—has satisfied us that this is not the case. Even some of our leading teachers know nothing about it. A few months ago, at a little gathering of gentlemen interested in physical science, the fact that the pictures formed in the two eyes are different was referred to by one of the company, together with the related fact that the two pictures of the stereograph differ in the very same way, when, much to the surprise of most persons present, both facts were squarely denied by a gentleman who had for many years been at the head of one of our best high schools, and for the greater part of the time a teacher of mathematics and physics. It was only after a long and rather lively discussion that he became convinced of his error. He had never before understood either the stereoscope or the eye, so far as its action is like that of the stereoscope.

Why do we have two eyes, when we see but one image with them, and apparently one eye would serve to form that image? There may be other reasons for the arrangement, but the most obvious one is *that we may see objects solid*, or in relief, and not merely as pictures on a plane surface. It was not until Wheatstone made his experiments on binocular vision, in 1838, that this matter came to be thoroughly understood, even by scientific men. He showed that the pictures in the two eyes are not exactly alike, and that it is the blending of these two pictures which causes objects to appear solid.

A moment's reflection ought to satisfy the reader that the pictures in the two eyes cannot be exactly alike, since the eyes are not in precisely the same position with reference to the object. But if "he don't see it," a simple experiment will enable him to see it. Let him hold a book or any other solid object about a foot from the eyes, and look at it first with one eye and then with the other. He will find that with the right eye he sees a little more of the right side of the object, and with the left eye a little more of the left side. The same will be true, of course, whatever may be the distance of the object from the eye, though when the distance exceeds 250 or 300 feet the difference is too small to be appreciable, and objects beyond that distance are not really seen to be solid.

Now the stereoscope is simply a contrivance for blending two pictures which differ from each other as the images in the two eyes differ. When thus blended the pictures produce the same impression of solidity as the object itself does when viewed with both eyes. Hence the name of the instrument, which is from two Greek words, meaning *to see solid*.



How is this blending of the pictures effected? If we look at an object through the center of a convex lens, it will be seen exactly in front of the eye; if we move the lens a little to the left the object will appear to move to the right; if we move the lens to the right the object appears to move to the left. If now we cut the lens into two semicircular pieces, and place them side by side in a reversed position—that is, so that their thin or curved edges are adjacent, and their thick, or straight edges are turned outward and parallel—the right eye will then look through the left half of the lens, and the left eye through the right half. If two pictures, like those of a stereograph, be placed at a proper distance behind the lens as thus divided and arranged, they will be seen, not in their actual places, but in a position midway between the two. The figure illustrates this: *m* and *n* are the halves of the lens; and *a* and *b* are the two pictures, which appear as one at *c*.

How are the two pictures obtained? They are photographs of the object taken from slightly different points of view Theoretically, they should be taken from points separated by a distance equal to that between the two eyes, or about two and a half inches; and for all objects within short distances this is just what is done. For objects farther off—as large buildings or landscapes of considerable extent—photographers usually take the pictures from points farther apart, the distance ranging from a few feet up to a quarter of a mile.

In this way, objects which are so distant that they are not really seen as solid with the unaided eye are brought out into clear relief by the stereoscope. Even the moon may be made to show her rotundity of figure by means of this instrument. Although she always turns the same side towards the earth she swings a little at times, so that we get a view of a little more of her eastern or western side; and by taking advantage of this swinging (or *libration*, as the astronomers call it), photographs can be taken corresponding to the images in the two eyes—or rather, as Sir John Herschel has remarked, "it is as though the moon were seen with the eyes of a giant, placed thousands of miles apart."

It has been suggested that similar photographs might be taken of the planet Saturn, with his system of rings. In this case an interval of two or three years would be allowed between the times of taking the pictures, in order that the position of the rings might change enough to answer the purpose.

A curious effect may be produced by tinting the pictures of a stereograph with different transparent colors. If, for example, one be colored blue and the other red, their blended image will appear purple; if blue and yellow be used, it will appear green, and so on. The colors are mixed *in the eye*, and the resultant color is precisely the same as if they had been mixed by a painter and applied to the picture outside the eye. We have seen French stereographs of statuary which illustrate this principle. One of the pictures is colored green and the other yellow, and the mixture of the two in the eye produces the exact tint of bronze.

Quite an amusing story is told of the first introduction of the stereoscope to the *savants* of France. The Abbé Moigno took the instrument to Arago, and tried to interest him in it; but Arago unluckily had a defect of vision which made him see double, so that on looking into the stereoscope he saw only a medley of four pictures. The Abbé then went to Savart, but he was quite as incapable of appreciating the thing, for he had but one eye. Becquerel was next visited, but he was nearly blind, and consequently cared little for the new optical toy. The Abbé, not discouraged, called next upon Pouillet, of the Conservatoire des Arts et Métiers. He was a good deal interested in the description of the apparatus, but unfortunately he squinted, and therefore could see nothing in it but a blurred mixture of images. Lastly Biot was tried, but Biot was an earnest advocate of the corpuscular theory of light, and until he could be assured that the new contrivance did not contradict that theory, he *would* not see anything in it. Under the circumstances, the wonder is that the stereoscope ever got fairly into France; but if you have any doubts on that point, a short walk under the arcades of the Rue de Rivoli, in Paris, will soon settle them. We question whether you will see anywhere else on earth more stereoscopes or stereographs than are displayed in the windows of the picture-shops of that noted thoroughfare.—*Journal of Chemistry.*

Patents.

Every really valuable invention is the result of long previous training, expensive experiment, and hard earnest thought. Such being the case, it becomes a matter of prime importance to the inventor that that which has cost so much in the past should be well secured for the future so as to insure to the owner an adequate return for his outlay, his anxiety, and his toil. If experience is worth anything in such matters (and in what department is it not of value?) no better aid can be found than in the office of Messrs. Munn & Co., of this city, the well-known publishers of the *Scientific American*. It is probable that they have taken out more patents than all the other patent agencies in the United States put together. The consequence is that their office is so extensive that, for the several departments, they can afford to give constant employment to specialists, men who have made a particular study of some one or two things. Hence, in their office an improvement in potato-diggers need not necessarily be confided to a man who has applied himself all his life to steam engines, nor an improvement in woolen carding to one who, though great, is great in fire-arms. A word to the wise is sufficient.—*Technologist.*

MINK FURS.—In all parts of Canada, where a mink track is to be seen in the soft mud along the banks of streams or lakes dead-fall can be found also. Trappers calculate that there is not a mink in the country for which a trap is not set. The animal being voracious is easily caught, and will soon become exterminated if not better protected. The fur is of very little use before the 1st of November, and yet minks are caught by hundreds during the month of October.

The Solar Engine.

Captain John Ericsson, of this city, has addressed a communication to *Engineering* in reference to his solar engine, in which he remarks that it is not intended as a competitor with the steam engine, where coal can be obtained; nor is it proposed, in the first instance, to erect this motor where there is not continuous sunshine.

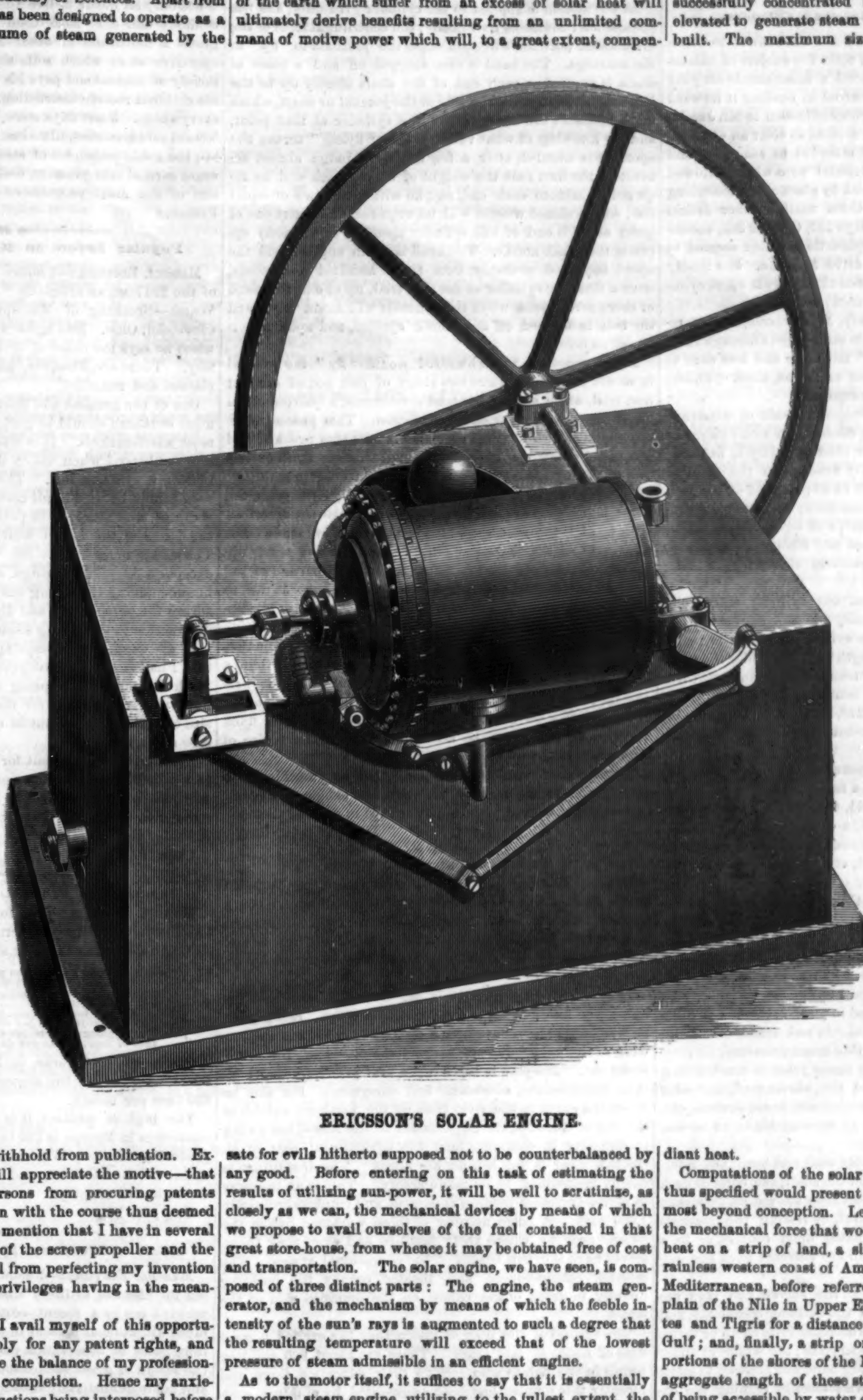
The accompanying illustration, which derives its chief interest from the fact that it represents a piece of mechanism actuated by the direct agency of solar heat, is copied from a photograph of a small solar engine just completed, intended as a present to the French Academy of Sciences. Apart from being a motor, this engine has been designed to operate as a *meter* for registering the volume of steam generated by the concentrated heat of a sunbeam of a given section. Regarded as a steam meter, it is important, as it verifies the results of previous experiments and previous calculations, based on the number of units of heat developed in evaporating a certain weight of water in a given time. Engineers will not fail to notice the unusual proportions of the working parts, nor will they fail to appreciate the object in view, that of reducing the friction to a minimum—an indispensable condition in a meter. The entire mechanism being shown with perfect distinctness, it is only necessary to explain that the square pedestal which supports the steam cylinder ($4\frac{1}{2}$ inches in diameter), the beam center, and the crank shaft, conceals a surface condenser.

Under a clear sun, the engine which our illustration represents, runs with perfect uniformity, at a fixed rate of 240 revolutions per minute, consuming at this rate only part of the steam furnished by the solar steam generator, now temporarily employed, belonging to an engine of greater dimensions constructed some time ago. With reference to ascertaining the amount of mechanical power developed by the solar engines, engineers need scarcely be reminded that, by dispensing with a vacuum, the atmospheric resistance and back pressure exerted against the pistons furnish accurate means for measuring the dynamic force transmitted by sunbeams of definite sections.

Plans and descriptions of the mechanism by which the sun's radiant heat is concentrated, and of the steam generator which receives the concentrated heat, I shall be compelled for some time to withhold from publication. Experienced professional men will appreciate the motive—that of preventing enterprising persons from procuring patents for *modifications*. In connection with the course thus deemed necessary, it will be proper to mention that I have in several instances—notably in the case of the screw propeller and the caloric engine—been prevented from perfecting my invention in consequence of conflicting privileges having in the meantime been granted to others.

Regarding the solar engine, I avail myself of this opportunity to say that I shall not apply for any patent rights, and that it is my intention to devote the balance of my professional life almost exclusively to its completion. Hence my anxiety to guard against legal obstructions being interposed before perfection of detail shall have been measurably attained. Within a few years the entire engineering community of both hemispheres will be invited to take the matter in hand. In the meantime, let us hope that no exclusive privileges may be granted tending to throw obstacles in the way of an unrestricted manufacture and introduction of the new motor wherever it may be applicable.

The foregoing having introduced the subject, let us now enter upon a cursory examination of the merits of the solar engine. The several experiments that have been made show that the mechanism adopted for concentrating the sun's radiant heat abstracts, on an average, during nine hours a day, for all latitudes between the equator and 45°, fully 3·5 units of heat per minute for each square foot of area presented perpendicularly to the sun's rays. A unit of heat being equivalent to 772 foot-pounds, it will be perceived that, theoretically, a dynamic energy of 2,702 foot-pounds is transmitted by the radiant heat, per minute, for each square foot; hence, 270,200 foot-pounds for an area of 10 feet square. If we divide this sum by the adopted standard of 33,000, we ascertain that 100 square feet of surface exposed to the solar rays develop continuously 8·2-horse power during nine hours a day, within the limits of latitude before mentioned. But engineers are well aware that the whole dynamic energy of heat cannot be utilized in practice by any engine or mechanical combination whatever, nor at all approached; hence I have assumed, in order not to overrate the capability of the new system, that a solar engine of one-horse power demands the concentration of solar heat from an area of 10 feet square. On this basis I will now proceed to show that those regions of the earth which suffer from an excess of solar heat will ultimately derive benefits resulting from an unlimited command of motive power which will, to a great extent, compensate for evils hitherto supposed not to be counterbalanced by any good. Before entering on this task of estimating the results of utilizing sun-power, it will be well to scrutinize, as closely as we can, the mechanical devices by means of which we propose to avail ourselves of the fuel contained in that great store-house, from whence it may be obtained free of cost and transportation. The solar engine, we have seen, is composed of three distinct parts: The engine, the steam generator, and the mechanism by means of which the feeble intensity of the sun's rays is augmented to such a degree that the resulting temperature will exceed that of the lowest pressure of steam admissible in an efficient engine.



ERICSSON'S SOLAR ENGINE.

As to the motor itself, it suffices to say that it is essentially a modern steam engine utilizing, to the fullest extent, the mechanical energy of the steam generated by the concentrated solar rays. Regarding the steam generator, it will only be necessary to state that it is not exposed to the action of fire, clinkers, or soot, and therefore can only suffer from the slow action of ordinary oxidation. We have, lastly, to consider the efficiency of the mechanism by means of which the solar heat is concentrated and the temperature raised above that of the water in the steam generator. Regarding this mechanism—concentration apparatus, it may appropriately be termed—it will be asked: Is it costly? Is it heavy and bulky, so as to render transportation difficult? And, finally, the question will be put, Is it liable to derangement and expensive to keep in order? I will answer these questions in the same order in which they have been presented. The cost is moderate. The weight is small—indeed, lightness is the most notable peculiarity of the concentration apparatus. As to bulk, this apparatus is composed of small parts readily put together. Regarding durability, the fact need only be pointed out that certain metals, however thin, if kept dry, may be exposed to the sun's rays during an indefinite length of time, without appreciable deterioration; hence, unlike the furnaces of steam boilers, which soon become unserviceable, structures protected, as the concentration apparatus is, by thin metallic plates, cannot be rendered unserviceable from the mere action of the sun's rays. Another question will be asked, whether the solar engine will answer as well on a large as it does on a small scale? The following reply will effectually dispose of this pregnant query. It is not necessary, nor intended, to enlarge in future the size of the apparatus by means of which the solar intensity has been successfully concentrated and the temperature sufficiently elevated to generate steam for the engines which have been built. The maximum size adopted has been adequate to utilize the radiant heat of a sunbeam of thirty-five square feet section. The employment of an increased number of such structures will therefore be resorted to when greater power is wanted, as we increase the number of hands when we desire to perform an additional amount of work. The motor itself, the steam cylinder and other parts, will obviously be proportioned as at present with reference to the pressure of steam employed and the work to be done.

Agreeable to our introductory remarks, it is not proposed, in the first instance, to apply solar engines in places where there is not steady sunshine. The isolated districts of the earth's surface suffering from an excess of solar heat being very numerous, our space only admits of a glance at the sunburnt continents. An examination of the extent of these will show that the field for the solar engine, even with the proposed restriction, is not very contracted. There is a rainless region extending from the northwest coast of Africa to Mongolia, 9,000 miles in length, and nearly 1,000 miles wide. Besides the north African deserts, this region includes the southern coast of the Mediterranean east of the Gulf of Cabes, Upper Egypt, the eastern and part of the western coast of the Red Sea, part of Syria, the eastern part of the countries watered by the Euphrates and Tigris, Eastern Arabia, the greater part of Persia, the extreme western part of China, Thibet, and, lastly, Mongolia. In the western hemisphere, Lower California, the table-land of Mexico and Guatemala, and the west coast of South America, for a distance of more than 2,000 miles, suffer from continuous, intense, radiant heat.

Computations of the solar energy wasted on the vast areas thus specified would present an amount of dynamic force almost beyond conception. Let us, therefore, merely estimate the mechanical force that would result from utilizing the solar heat on a strip of land, a single mile in width, along the rainless western coast of America; the southern coast of the Mediterranean, before referred to; both sides of the alluvial plain of the Nile in Upper Egypt; both sides of the Euphrates and Tigris for a distance of 400 miles above the Persian Gulf; and, finally, a strip one mile wide along the rainless portions of the shores of the Red Sea, before pointed out. The aggregate length of these strips of land, selected on account of being accessible by water communication, far exceeds 8,000 miles. Adopting this length and a width of one mile as a basis for computation, it will be seen that the assumed narrow belt of the sunburnt continents covers 223,000,000,000 of square feet. Dividing this by the area necessary to produce one-horse power, we learn that 22,300,000 solar engines, each of 100-horse power, could be kept in constant operation, during nine hours a day, by utilizing only that heat which is now wasted on a very small fraction of the land extending along some of the water-fronts of the sunburnt regions of the earth.

It will be said that these extravagant figures are devoid of practical significance. Due consideration, however, cannot fail to convince us that the gradual exhaustion of the coal fields will inevitably cause great changes in regard to international relations, in favor of those countries which are in possession of continuous sun-power. Upper Egypt, for instance, will, in the course of time, derive signal advantage, and attain a high political position, on account of her perpetual sunshine and the consequent command of unlimited motive force. The time will come when Europe must stop her

denied by a gentleman who had for many years been at the head of one of our best high schools, and for the greater part as one at c. ... tober.

mills for want of coal. Upper Egypt, then, with her never-ceasing sun-power, will invite the European manufacturer to remove his machinery and erect his mills on the firm ground along the sides of the alluvial plain of the Nile, where sufficient power can be obtained to enable him to run more spindles than a hundred Manchesters.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Constructing and Balancing Cylinders.

MESSRS. EDITORS:—Having noticed your answer to correspondents on page 106, August 13, upon the subject of balancing cylinders and pulleys, I prepared a short article for your paper, but unavoidable delays occurred in sending it forward at the time. Next I noticed the communication of Mr. Jacobi, on page 148, September 3, which seemed so clear an explanation that I laid aside what I had intended to send you, and prepared a short reply to your editorial note which followed said article. This was also delayed by absence in attending the late State fairs and trials at Utica until another article from Mr. Jacobi appeared on page 232, October 8th, accompanied with illustrations and explanations which seemed to hit the nail on the head and to drive it home. His theory and practice cannot be misunderstood and with short cylinders must insure uniformly favorable results.

The practice of your Schenectady, N. Y., correspondent, referred to by your editorial notes on same page, although rude, "and upon the cut and try plan" are none the less sure to produce the same ultimate results as far as short cylinders without intermediate heads are concerned.

Your Timberville, Va., correspondent's mode of constructing cylinders, as described in the editorial on same page, by which each end and intermediate head or pulley is balanced separately as they are successively fixed upon the shaft in position, is the only proper mode to be practiced so far as it applies to the end heads or intermediates; but as to balancing the staves or lags for covering, each one separately, it seems to be a useless process—labor lost, and wholly impracticable in the construction of conical cylinders of any length, long or short.

It is only by a velocity test that any cylinder, when completed, can be properly balanced, by the application of weight at the ends or along the cylinder where it is really required, and the greater the length of the cylinder the more important becomes this velocity test and balancing, notwithstanding the statement to the contrary, in your Virginia correspondent's article on page 243, October 15, in which he states "that a long cylinder cannot be perfectly balanced after once constructed."

In regard to balancing millstones alluded to in same article, I will not now reply, but may at a future time.

The communication on page 261, October 22, by your Morrison, Ill., correspondent, is so wide of mechanical, practical, or scientific merits, as not to require any comments, except to characterize it as simply absurd, and carries its own worthlessness with it.

As I have devoted more than thirty years to practical and professional mechanics, and had much experience, and always with successful results with what I have undertaken, I assume that the mode adopted by me in the construction of cylinders of all kinds, large or small, heavy or light, long or short, cylindrical or conical, and for high or low speed, may be of sufficient interest to be inserted in your columns and meet with favor among your correspondents and readers, I therefore send to you for publication this communication.

My chief business has been for many years in constructing thrashing machines for grain and rice, clover seed, and cider mill graters, cotton gins, and condensers, horse-powers, etc. Many of these require cylinders of various kinds as to size and speed, etc.

In constructing a cylinder, I affix each end head, and intermediates (if any), in position upon the shaft, and balance each one separately and successively as they are put on by means of the steel bars and spirit level, by resting the journals themselves upon the bars (but never upon centers, as in a lathe), and am careful to avoid all air currents upon the cylinder during the process.

When ready for the covering, the staves and lags are strongly fixed to the heads and the cylinder completed, and spikes inserted in a manner to withstand fully twice or thrice the speed required in practical operation; the whole cylinder is again placed upon the balancing bars, and allowed to settle itself with its heaviest side down; then by turning the extreme upper portion of the cylinder down to a line horizontal with the axis of the shaft a lump of putty is pressed upon this point and on a level with the shaft, and more or less putty applied until a perfect balance is obtained, so the cylinder will stand in any position at rest.

The putty is then removed and placed in a balance, and two slugs of iron of equal size are selected and placed in the opposite balance, which shall just equal the weight of the putty, or by using a flat piece of thin steel plate, with its edge or corner tacked on to the cylinder at the periphery and at the end on a horizontal line with the shaft; and instead of using putty, slugs of iron in pairs are selected and laid upon the plate until the exact weight to balance is obtained, when they are inserted, one at each end, and upon the light side of the cylinder as near the periphery as practicable. This process may require to be repeated once or twice, but is usually accomplished at the first trial.

If the cylinder or pulley to be balanced is iron, then the slugs must be drilled and bolted or made fast in some safe manner.

This accomplished, the cylinder is removed to a heavy substantial frame, and placed in fixed and strong bearings, and belt motion applied to it by an accelerating clutch coupling to the line shaft or counter shaft of the manufactory. The bearings are so made as to allow of nearly one eighth of an inch play to the journals or may be made to fit closely at pleasure of the operator, and both are required with some cylinders, especially with all long ones.

The object of the strong, heavy frame is to cause the cylinder itself to vibrate in all its unbalanced lines instead of the bearings on which it is mounted.

As the motion is applied to the cylinder gradually, and the speedometer indicates its velocity, the centrifugal force of the unbalanced portions will soon cause the journals to "fly" in the bearings. The band is then shipped off and a piece of chalk is applied at each end of the shaft closely up to the journals, so as to mark the side of the journal or shaft, which mark indicates the heavy side of the cylinder at that point, and by knowing at what velocity this "flying" occurs the operator is enabled, after a few trials, to judge almost accurately the first time the weight of slugs which will be required to balance each end, and he will select two of equal size, whose united weight will be required, and insert one of them at each end of the cylinder upon the side exactly opposite the chalk marks. The band is again applied, and the speed increased probably from three hundred revolutions, with a thrasher cylinder at the first trial, up to one thousand or more revolutions when the journals will again "fly," and the belt is slipped off and chalk applied, and speed ascertained as before.

If the speed of three hundred would "fly" the journal it would probably require two slugs of one pound each at first trial, while at one thousand revolutions, a quarter of an ounce for each slug would be sufficient. This process is repeated until two or three thousand revolutions are attained and the slugs required become so small that one third or less of a twopenny nail is driven in and broken off.

In balancing large cylinders, and especially light ones, the chalk indications are taken at the ends as before described with large bearings, after which the bearings are made tight to prevent any flying at the journals, and motion being applied gradually as before, until the middle portion of the cylinder is observed to describe a larger circle than is due to its true diameter. This is also indicated with chalk by slipping off the band as before.

A careful and observing workman, with a little practice, finds no more difficulty in balancing a long cylinder than a short one, although it may require a few more trials in proportion to its length than a short one. It is this balancing of long cylinders on a heavy substantial frame and fixed bearings which cannot be accomplished with the device of Mr. Jacobi, described on page 232, October 8.

To the perfect "velocity balancing" of our machines are greatly due their success, durability, and efficiency as well as their light consumption of power used in driving them.

Albany, N. Y. HORACE L. EMERY.

The Familistery of Guise.

MESSRS. EDITORS:—One of the most interesting things I saw in Europe was the Familistery of Guise, France. It is a self-supporting school or home of a peculiarly practical and modern type, and although it is the effect of the genius and perseverance of one man, yet it deserves imitation by co-operative societies.

This enterprising genius is M. Godin, a machinist by trade, who followed his profession fifteen years. Being poor, he was only able to develop his plan by degrees, and the left wing of the palace was not entirely completed when the war broke out. His plan is based upon four principles—agriculture, manufacture, education, and enjoyment. For this he selected a curve in the river Oise, on the northern suburb of the city of Guise, in the Department of the Aisne, but owing to difficulty in obtaining land, the agricultural part of M. Godin's ideal is far behind his hopes. The institution is chiefly maintained by its manufactory. This is an industry in stoves and other heating apparatus, and employs ordinarily 1,000 men. A large number of these workmen live in the palace near by, where their families and even they themselves have the free benefit of the educational system. The schools, eating-houses, and theater occupy the building directly in front of the palace, on the opposite side of the street.

The success of the plan of instruction has excited a good deal of notice of late years. There are about 300 children living in the palace who receive their education there, and recently this number has been augmented by children coming from the city. So great has been the prejudice against this institution by the outside world that it not only was discountenanced by Napoleon, but several strong efforts have been made to break it up by bankrupting its founder. But it has triumphed over all calumnies, and no other cause attributable to this triumph can be greater than that of the schools.

The main feature of this institution is the palace, which is situated in the center of the garden, and consists of three edifices, each in form of a parallelogram, with a central court covered with glass—a main structure and two wings. These are four stories high, and are divided into 324 residences, each large enough to accommodate a family, and including from two to four rooms and an anteroom. The main structure has a front of 200 feet, with a depth of 130 feet. Its inner court is 150 by 65 feet. The wings are 160 by 140 feet, with magnificent inner courts, all furnished with cement floors, and covered with glass which admits light but no rain.

The corridors, galleries, and stair-cases are artistically constructed, and form at every floor of the palace a fine promenade. Such is the economy of the structure that a single gaslight sufficiently illuminates each court, casting distinct rays upon every door of the residences. These residences are so entirely separated one from another that they resemble houses in cities, and it often happens that near neighbors are unacquainted with each other. To give an idea of the cheapness of these rooms, let me say that the cost per month of one kitchen 10 by 13 feet, a parlor 12 by 14 feet, a cabinet 4½ by 6, lighted, and the vestibule, is two and one half dollars.

The workingman is fortunate who lives in this palace. It is not only an honor to live there, since it is far more commodious and *à la mode* than other houses, but he enjoys gratis a multitude of other favors peculiar to it. A co-operative store which sells at cost is in the basement. A society of mutual aid pays his physician's bills, and he and his children receive instruction. Music and merriment echo everywhere. Feast days come, and are celebrated with intellectual concurrencies, illuminations, and garlands; and above all, the noble principles of conscientious liberty are in every sense carried into practice, making the Familistery of Guise one of the most progressive workingmen's institutions in France. C. OSBORNE WARD.

Popular Errors in Regard to the Watch.

MESSRS. EDITORS:—I notice in the SCIENTIFIC AMERICAN, of the 22d inst., an article on "Popular Errors Regarding the Watch—Breaking of Mainsprings," by Mr. R. Cowles, of Cleveland, Ohio. I do agree with Mr. Cowles in his remarks, when he says the cause of breakage is an unexplained mystery. There are, however, many causes which can be explained and remedied.

One of the greatest and most frequent errors—one that no good workman should be guilty of—seems to prevail among most watch-makers. It is made by putting the mainspring into the barrrel when taken down to be cleaned, or in replacing it by a new one. The mainspring winder generally used cannot be used in all cases, and is not satisfactory when it can be used; besides in putting in the spring it will mar the flange of the barrel which serves to hold the cap on. The consequence is that the winder is scarcely ever used, except on very stiff springs, and they are put in with the fingers, forcing the spring out of shape, and leaving on the spring the perspiration and dirt of the hands, which causes destruction to the spring sooner or later.

I have adopted a mainspring winder of my own invention, that I have used for two years without a single breakage. With this winder the spring need not be touched with the fingers after it is ready for the barrel; besides, any kind or size of springs can be put in quicker and with the greatest ease and regularity.

I procured letters patent for this tool through your agency, as well as for several other useful tools of my invention. You will please accept my thanks for the prompt and satisfactory manner in which you have conducted the business I have intrusted to your care. M. D. KELLY.

Cadiz, Ky.

Remarkable Production of Bessemer Steel.

MESSRS. EDITORS:—The following was the product of the two five-tun Bessemer converters at the works of Messrs. John A. Griswold & Co., Troy, for the month of October:

No. of whole working days in the pay-roll month	27½
" " days in which steel was made	26½
" of days stopped for repairs	1
Total tuns of steel ingots made	1,686½
" No. of charges made	349
Average tuns of ingots made per charge	4·83
" No. of charges made per day	13·18
" tuns of ingots made per day	63·64

One of the best works in England, advertises that it can make, with the six-tun converters, 150 tuns per week, or say 650 tuns per month.

The highest product, it is believed, of a pair of five-tun converters in Europe is 750 tuns per month. The remarkable product of the Troy Works—1,686 tuns—is due to improvements developed there, and coming into use in the other works in this country. STEEL.

Troy, N. Y.

Effect of Artillery Discharges on Weather.

MESSRS. EDITORS:—I send you the following table showing the effect of artillery discharges on weather, a subject which I see by a recent editorial in your paper is exciting much attention at present in Europe. The table is prepared from notes of observation made on weather in the vicinity of the scenes of great battles fought during our own recent war, and made immediately subsequent to these battles, and shows the time, after the battles, which elapsed before rain fell:

Resaca—One day after.
Kenesaw—Three days after.
Jonesboro'—Five days after.
Altoona—All night and next day.
Nashville—All night and next day.
Franklin—Two days after.
Fort Anderson—Five days after.
Kingston—Five days after.

In all these battles from 40,000 to 100,000 men were engaged. E. W. BROWN.

Cambridge, Ill.

THE DARLING SELF-SUPPLYING PEN-HOLDER.—Mr. B. L. Goulding, of 108 Fulton street, New York, recently left on our table one of the above fountain pens. It contains enough ink to write several pages of manuscript without refilling. They fill by simply placing the point of the pen in the ink, and exerting a slight pressure with the thumb on the side of the holder. It is one of the best fountain pens we have seen.

PROGRESS OF INVENTION ABROAD.

In a paper read before the British Association for the Advancement of Science, Mr. J. W. Cooper, who has given much attention to the

WATERING OF STREETS BY CHEMICALS,

states that three streets in the city of Liverpool were watered with salts during the month of July, 1869, with very favorable results, so much so, that the experiments were continued this year. It was difficult to prove the economy resulting from the use of chloride over a limited area; and the Westminster Board of Works, after observing the effect produced at Whitehall and Knightsbridge, resolved to extend the experiment throughout their entire district, comprising an area of 250,000 square yards. As soon as the area was extended, the economy in labor and water was at once made evident. By using one tun and a half of chlorides per day, costing £3 15s., the labor of ten cart horses and men, costing £4 10s. (at 9s. per horse, cart, and man), can be dispensed with, and, consequently, the quantity of water they would spread is saved also, viz., 350 loads of 250 gallons each, which, at 10d. per 1,000 gallons (a fair average price for water in London) would amount to £3 12s. 11d. in addition to the 15s. per day saved in labor; thus showing a clear gain of £4 7s. 11d., after paying for the salts. An effective method of remedying the evils arising from organic matter deposited on public thoroughfares is becoming daily a serious matter for consideration with sanitary authorities,as much sickness is believed to arise from the malaria emanating from this source. The disgusting odor and dangerous nature of some of the deodorizing agents used were strong evidence that they would not be used at all if the necessity for some determined action to prevent the spread of contagion and disease was not fully recognised. The deliquescent chloride of aluminum, recently introduced to public notice by Professor Gamgee, seemed to meet all the requirements needed in the antiseptic of the future. It was non-poisonous and free from any odor; it prevented decomposition, and arrested it when commenced. It absorbed noxious gases resulting from putrefaction,and destroyed parasites and germs. It was also not to be surpassed as a precipitant and deodorizer of sewage, and was only one-third the cost of carbolic acid. Mr. Cooper proposed to add a sufficient percent age of this chloride to the salts for street watering, and thereby afford a means of thoroughly and effectually purifying public thoroughfares without additional cost to the ratepayers, the value of the water and labor saved being more than sufficient to pay for the use of the chlorides.

A very ingenious automatic device for

FLUSHING SEWERS

has been produced by a London inventor. In this device, the flood-gate is hinged, opening upward and outward upon the release of a hook bolt by the buoyant power of a large copper float. Many lives have been lost through the action of poisonous gases,in flushing sewers,which flushing this simple device does whenever it is required. The rush of accumulated water swings the gate outward, and, also, carries off accumulations of sewage. As soon as the flood current subsides, the gate swings back to its original position, and is automatically locked.

A machine for

HACKLING LONG VEGETABLE FIBERS,

such as aloe, manilla, hemp,etc., consists of a drum, revolving on a horizontal axis, and armed with teeth or spikes pointed at the end, and having sharp, annular edges in front, or at the front and back. This drum is of such a size that the fiber upon the machine shall not be able to lap more than about half way round it. This is an English invention.

A French invention, in the same line as the above, is a machine for

COMBING FLAX.

Two endless chains, consisting of flat links, are caused to travel together over flat-sided pulleys,and disposed, one above the other; the two adjoining or opposing surfaces of the two chains being held in contact with each other by passing between guides. These surfaces form nippers for holding the tufts of fibers while being combed or straightened, and serve to carry them along, at the same time, to a receiving trough, wherein each tuft is deposited in succession, the one overlapping slightly the other. The bottom of the receiving trough consists of an endless traveling band, which continuously conveys away the combed tufts in the form of a ribbon or sliver. A vibrating arm, worked by a crank and provided with a crosshead or rake, serves to take each tuft as it is released from the nippers, and draw it into the receiving trough.

A Swedish inventor has patented a process for making

ARTIFICIAL LEATHER.

He takes leather wastes, leather cuttings, leather shavings, or other small bits of leather,either new or old,and reduces them to a kind of fibrous pulp, by hand labor, or by a machine or mill (either by grinding, pounding, cutting, rasping, carding, or grating); if old waste is used it should first be cleaned thoroughly. This matter or pulp is then kneaded with india-rubber, which is rendered fluid, or dissolved in oils or spirits, and treated with ammonia. He prefers to dissolve the india-rubber in oil of turpentine. To effect this, the inventor cuts the india-rubber into pieces and mixes it with the oil, after which he lets it remain quiet in a closed vessel until it is dissolved. When the india-rubber is dissolved, he adds ammonia, of a strength of 30 per cent, in the proportion of about equal parts by weight, of ammonia to the india-rubber contained in the solution; when the mass has become of a grayish white color it is ready to be mixed with the pulp.

A Liverpool inventor has patented a taper or

FRICTION LIGHT,

which is made after the following formula: He takes one ounce saltpeter, one half ounce powdered orris root, one eighth-ounce of minium, and one ounce of phosphorus, or any other convenient friction match composition. To these ingredients, the phosphorus being dissolved, he adds one to two ounces of oil, preferably castor oil, varying the quantity according to the nature of the oil and the resultant tenacity or flexibility required. After all the ingredients are well incorporated, the inventor adds thereto chloride of sulphur, in the proportion of from ten to fifteen parts of liquid chloride of sulphur to every hundred parts of oil, agitates quickly, and shapes into the form required, either by molding, cutting, pressing, or drawing.

A new method of

PAVING STREETS,

—French—consists, first, in the employment of wood disintegrated into fragments, of as great a length as possible, in the construction of rides and bridle paths, carriage drives, riding schools, and training grounds, streets and roads of all kinds. Second, in the employment of disintegrated wood of shorter length than the preceding, in the construction of foot paths of all kinds for promenades and gardens. Third, in the employment of disintegrated wood mixed or not with pitch or with antiseptic material, or both, as a cushion for supporting the sleepers of railways. Fourth, in the employment of this disintegrated wood mixed with pitch obtained from gas tar or otherwise, or with natural asphalte or bitumen in the construction of roads, footways of streets, public drives, and any description of works in which asphalte is ordinarily employed.

Sir William Fairbairn, of Manchester, England, has invented an improvement in

STEAM BOILERS,

in which he combines together three cylindrical shells of boiler plate. He arranges them parallel, the one to the other, and horizontally, or nearly so. Two of the cylinders, which are set side by side, are each traversed from end to end by an internal tube in which are the furnaces, and these cylinders each communicate with the third cylinder, which is placed over and between them by three or other number of pipes or passages, of sufficient size to allow the steam generated in the lower cylinders to escape freely into the upper, and to allow the water freely to circulate.

SCIENTIFIC INTELLIGENCE.

THE REDUCING PROPERTIES OF METALLIC ALUMINUM.

In reference to the action of aluminous upon metallic solutions there exists a diversity of information in our books, and to settle the point an Italian chemist, Professor Cossa, has instituted a number of experiments, an account of which we find in the journal *Nuovo Cimento*.

SALTS OF SILVER.—The metal is thrown down in dendritic form from weakly acid and neutral solutions of nitrate of silver. The precipitation of the silver begins in the concentrated as well as in the dilute solution of the nitrate six hours after the immersion of the aluminum. Silver is immediately precipitated from an ammoniacal solution of the chloride of silver in granular form, and also from ammonia—chromate of silver.

COPPER SALTS.—At first aluminum has no action upon solutions of sulphate or nitrate of copper, but after the lapse of two days small crystals collect on the sheet, and gradually increase in size, partly dendritic, but chiefly octahedra. Copper is at once thrown down from a solution of the chloride and also from the acetate, and if to the sulphate or nitrate a little chloride of potassium be added, the precipitation of the copper is greatly accelerated.

SALTS OF MERCURY.—Aluminum at first throws down metallic mercury from solutions of the chloride, cyanide, and nitrate, but this soon forms an amalgam with a second portion of the aluminum and produces a compound that decomposes water rapidly and also oxidizes quickly in the air. If an amalgam of aluminum and mercury be produced by heating the two metals in an atmosphere of carbonic acid, it exhibits similar properties to those mentioned above. Professor Wurtz, of New York, was the first to call attention to the remarkable properties of the amalgam of aluminum and mercury at a meeting of the Lyceum of Natural History more than a year ago. He prepared it by rubbing aluminum foil and mercury together.

SALTS OF LEAD.—Aluminum separates lead in crystals slowly from solutions of the nitrate and acetate and rapidly from the chloride. Also an alkaline solution of chromate of lead is decomposed by aluminum into metallic lead and oxide of chromium.

SALTS OF THILLIUM.—Regular octohedra crystals of thallium alum formed upon the aluminum foil from a solution of the sulphate after the lapse of ten days. Metallic thallium was immediately thrown down from a hot solution of the chloride.

SALTS OF ZINC.—Aluminum immediately precipitates metallic zinc from alkaline solutions.

The aluminum employed in the above experiments was free from every trace of sodium, and applied in the form of thin sheets after having been cleaned in nitric acid.

ACTION OF ELECTRICITY UPON AIR AND OXYGEN IN THE FORMATION OF OZONE.

A. Houzeau, after a series of 400 ozone determinations of the action of electricity on air and oxygen, comes to the following conclusions:

1. The production of ozone is greater in renewed than in confined air.
2. It is greater at the negative than at the positive pole.
3. It increases only up to certain limits with the duration of the electric action.
4. The intensity of the electricity adds to the amount.
5. It diminishes when the distance of the electrodes is increased.
6. It varies with the length or surface of the electrodes.
7. Under otherwise analogous circumstances more ozone is produced when the effect of both electrodes are employed.
8. The formation of ozone takes place when the air is not in direct contact with the electrodes, as when the points are isolated in a thin glass tube, but the effect is greater when the air is in contact with the poles of the battery, and it varies in proportion to the length and superficial area of the metallic electrodes.
9. The production of ozone increases as the temperature of the air diminishes.
10. Under like circumstances a given volume of oxygen yields far more (8 to 10 times) ozone than the same quantity of air.
11. Besides ozone there is always some nitrous oxide produced in the air, whereas in pure oxygen there is none.

After the author had ascertained these results, he was able to invent an apparatus by aid of which he could at any time prepare ozone in any quantity from the air or oxygen. Unfortunately the description of the apparatus is wanting, but the experiments made by Houzeau, and the results at which he has arrived, will be of value to future experimenters. We need a cheap and practical invention for producing ozone at pleasure, as its powerful chemical properties render it of great value in the arts.

ICE PAPER.

Paper may be made to resemble the figures produced by the flakes of snow or the freezing of water on a window pane by allowing a salt to crystallize upon its surface. During the Paris Exposition card paper thus prepared from sugar of lead was very popular, but it was discovered that the lead salt turned black, and its poisonous character soon brought it into disrepute. A new mixture without lead has been suggested by Puscher—it is prepared as follows: Dissolve 6 ounces sulphate of magnesia in 6 ounces of water and add 6 ounces dextrine mucilage paste. The solution is boiled, a little glycerin dropped in, and the whole allowed to cool. The paper, after having been previously glazed with a coating of glue and gelatin must be uniformly covered with the solution and left to dry in a warm place. After 10 or 15 minutes the surface of the paper will be covered with a uniform cluster of crystals, the size and number of which will be dependent upon the concentration and temperature of the bath and also of the heat at which it is dried. If the paper be glazed with a solution of egg albumen instead of glue and gelatin, it can be beautifully dyed with aniline colors previous to immersion in the solution of sulphate of magnesia. This kind of ice paper does not undergo any change in sulphureted hydrogen gas, and is not poisonous.

ACTION OF HEAT UPON COAL.

If powdered coal, after having been dried until its weight remained constant, be heated in a drying oven from 356° to 360° F., it has been found by Dr. Richter that there is a constant increase of weight up to a certain point, after which it begins to diminish. After twelve hours heating the increase amounts to several per cent of the original coal—after twenty hours it reaches its maximum and further heating causes it to lose weight. Coal which has thus been heated has simply its external appearance in common with the original sample. It has a higher specific gravity, in one instance going up from 1·275 to 1·453, and its chemical constitution is different. If we compare the composition of dry coal with the heated, the latter shows much less carbon and hydrogen, and a considerable increase of oxygen and nitrogen. An accurate analysis demonstrated the loss of hydrogen to be 0·74 per cent, and of carbon 1·17 per cent, while the increase of oxygen and nitrogen occasioned by the next was 0·07 per cent. If the heated coal be made red hot, it no longer yields coke, and does not materially change in appearance. If it be heated rapidly, an exceeding great swelling up takes place, and the escaping gases which carry off the carbon in powder, burn with a non-illuminating and not smoking flame. Finally the heated coal absorbs water from the air more rapidly than the dry coal.

Bessemer on Steam Artillery.

Mr. H. Bessemer has lately aired his ignorance of military and steam engineering in a proposition to use steam as a projectile agent in artillery. His plan, which he attempts to support by a string of absurdities, is briefly as follows: He proposes to apply the principle of the steam fire engine to the projection of bullets. He calculates that, with a pressure of 150 pounds of steam, one ounce and two ounce bullets might be projected with an initial velocity of 1,600 feet or 1,800 feet per second, at the rate of 2,000 per minute of the smaller and 1,000 per minute of the larger missiles. Mr. Bessemer proposes to submit details to the War Office; but he seems confident of the practicability of combining the bullet projector with the traction engine, and of so producing a warlike machine of most formidable and deadly character.

AN ICE LENS.—It is interesting to observe that radiant heat from the sun may be collected into a focus by means of an ice lens, and yet produce all the effects of an ordinary burning-glass. Such a lens, for experiment, may easily be made by placing a flat cake of ice upon a warm concave surface of metal or porcelain dish, such as an evaporating dish used by chemists; as soon as one side has assumed the proper form, the ice must be turned to make both sides alike. Any sunny, crisp, frosty morning will be suitable for this experiment; from which we learn that in Northern regions it would be quite possible to raise a fire without matches —a fact not altogether unworthy of being known.

DEVICE FOR SPREADING CIRCULAR SAW TEETH.

We illustrate in connection with the present article a device for spreading the teeth of circular saws to give the proper clearance, and improve the cutting edges.

Fig. 1 is a perspective view of the principal part of the device, shown attached to the saw; and Fig. 2 is a view of a punch used in connection with the plate, B, in Fig. 1, for spreading the teeth.

A, in Fig. 1, is a plate made of cast or wrought metal, with ears attached to its sides between which the teeth of the saw are placed during the operation of spreading. B is a steel plate firmly attached to the plate, A, by screws, or in any other suitable manner, and which serves as an anvil in in spreading the teeth.

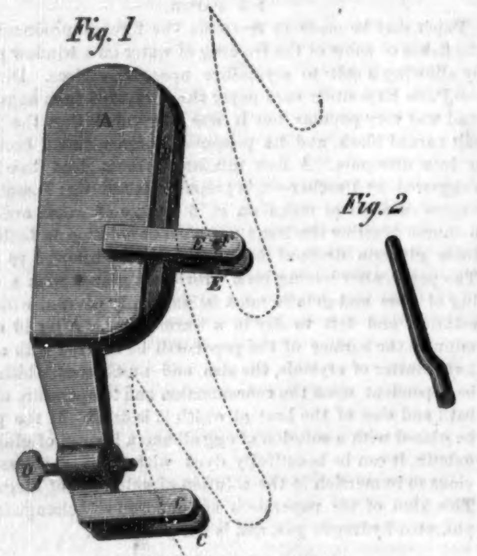
The plate is applied as shown in Fig. 1. The ears, C, serving to hold the plate in position on the saw. The distance to which the ears lap on to the teeth of the saw is governed by the gage screw, D. The outer ends of the ears, E, are connected by a pin, F. The tooth to be operated upon is passed through the space between this pin and the steel plate, B, as shown, the position of the point of the tooth being governed by the gage screw, D.

The space between the ears, C, is designed to be just wide enough to admit the saw at or near the base of the tooth, and the space between the front ear, E, admits the point of the tooth.

When the point of the tooth is placed on the steel anvil,

Fig. 1

Fig. 2



B, the punch shown in Fig. 2 is applied to it, and a blow of a hammer thereon spreads the tooth laterally in each direction, forming small lips on each side of the point, which are claimed to serve in place of the ordinary "set" to give the proper clearance. The punch is made in the form shown, so that it may be set squarely on the tooth.

It is claimed that the cutting point of the tooth is thus made thin and sharp, and that its edge may be kept longer under wear than by ordinary filing. Also that the lips formed on the tooth make the cut much smoother than when saws set and filed in the old style are used.

Patented, through the Scientific American Patent Agency, October 14, 1870, by W. H. Rudolph, Clarksville, Tenn., whom address for further information.

Honors to the Inventor of Telegraphy.

Prof. S. F. B. Morse, the inventor of telegraphy, presided at the late annual meeting of the Western Union Telegraph Company, at the close of which Mr. William Orton, President of the company, made the following very "personal" remarks:

"I cannot but regard it as a circumstance of peculiar interest connected with this day's proceedings, that at the head of this table, and presiding over this body sits our venerable friend, Professor Morse, the father of all the telegraphs. In the same presence sit to-day, participating in the annual services of the largest telegraphic organization of the world, the man who made its existence possible, and the men who made it. It seems a deeply interesting fact that from the brain of a single man who yet mingles with us thus so unassumingly, and who, though crowned with the honored hoar of nigh eighty years, is yet clear of eye and firm of foot, there sprang a design which has given a language, and a literature, and a means of instant audience with the world. It is significant, also, of that design that is so simple as to be elementary, and so complete as to have challenged, unimproved, the acceptance of the world. I therefore, for myself, and I think for you, also, gentlemen, desire to offer to our illustrious Chairman the warmest congratulations on the auspicious development of the art to which he gave birth, and to desire for him all that may render his ripened years as happy as they are honored."

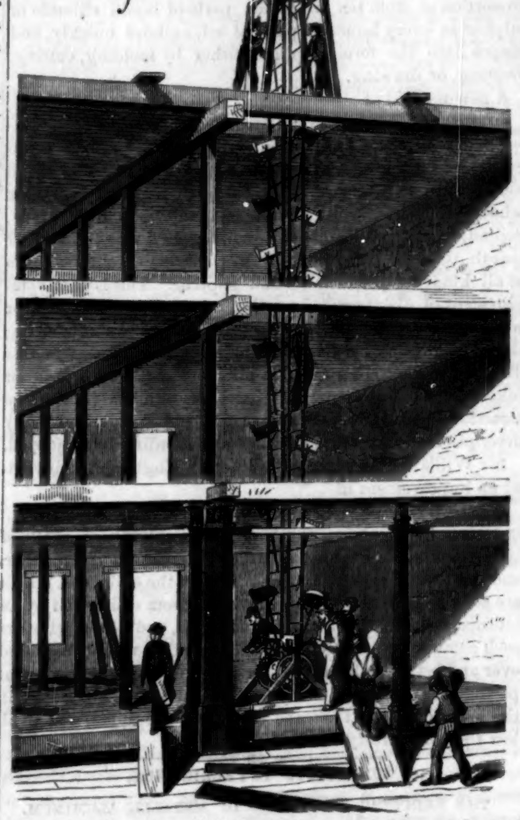
The telegraph operators and others in various parts of the country have contributed the money for the erection of a splendid monument of Morse, which is soon to be placed in Central Park.

HORRORS OF WAR.—It will bring home to our readers the murderous extent and horrors of the war when it is announced that the Prussian Government has ordered the supply of two hundred thousand wooden legs.

POWER'S ENDLESS LADDER HOD ELEVATOR.

The folly of carrying bricks and mortar up long ladders by the climbing action of human arms and legs, has been often deprecated in this journal as a disgrace to modern engineering. Nor have our views upon this subject been unseconded. Prominent architectural and engineering periodicals, both in this country and Europe, have joined in our cry of "down with the hod."

Fig. 1.



It seems, however, that the hod counts for more than we and our cotemporaries have reckoned. In conversations with practical builders we have been told that no other instrument has yet been devised rivaling in convenience the hod for carrying on scaffolds, over joists, and narrow plank ways, and on this account devices heretofore invented to elevate building materials, have failed to secure popular favor.

We illustrate, however, this week, a device which retains all the convenience of the hod as a distributer with ample elevating facility, and which is both simple and ingenious.

It consists of an endless chain ladder, A, Fig. 2, with iron rungs, upon which the hods with their contents are suspended by flat hooks, as shown at B. The endless chains run over flanged pulleys, C, placed on a suitable frame at the top, and the lower ones being impelled either by hand or other power. Hand power is, on all accounts, preferable, perhaps, for this purpose, and it also avoids the jar occasioned by steam or horse power.

Fig. 2

The hods are placed upon or taken off the rungs without stopping the motion of the endless ladder, and as the weight of the hods on one side is balanced by that of those on the other side; no power is expended except that required to overcome the friction of the machine, and to raise the materials.

We are told that seven hods of bricks and mortar can be raised per minute by the labor of two men at the cranks, and to any hight usual in building; an immense increase of useful work, over what the same men could perform in climbing a ladder with hods upon their shoulders, carrying their own weight with that of the hod and contents.

The space necessary for passing the hods up is only twenty inches by six feet. The apparatus being vertical requires less space than the ordinary ladder. The hods being detachable from the chain, the materials do not need to be handled to put them in hods or buckets for distribution after their elevation, as is the case with bucket elevators and other mechanical devices, and the breakage caused by this handling is saved.

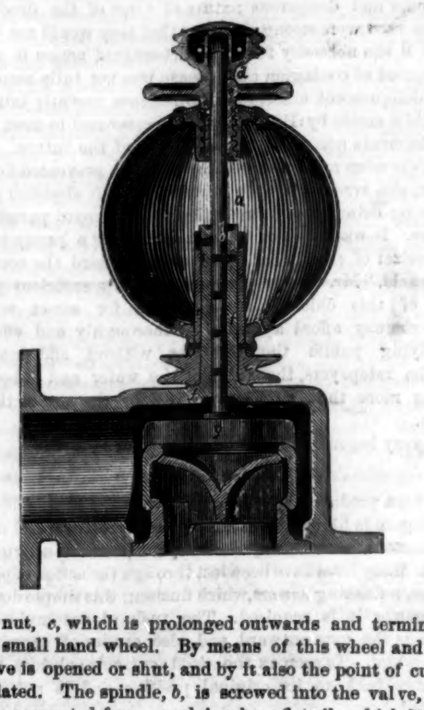
The apparatus is now in use by some of the most extensive builders in New York and Chicago, and we are informed that two manufactories in Chicago are now employed in their construction. Portions of the right will be sold.

Patented, through the Scientific American Patent Agency, July 14, 1870, by Jesse Powers. Address for further information J. Powers, Broadway, corner 49th street, New York or 106 Monroe street, Chicago, Ill.

BOURNE'S SPHERICAL STEAM ENGINE GOVERNOR.

Mr. John Bourne, who has an enviable reputation as a constructor of, and writer upon, the steam engine, has recently invented the novel form of governor which forms the subject of the accompanying engraving, copied from the *Mechanics' Magazine.*

In the engraving, *a* represents a hollow sphere, which is made of thin brass, rendered elastic by hammering and divided into segments. On one end of the central spindle, *b*, is



a brass nut, *c*, which is prolonged outwards and terminates with a small hand wheel. By means of this wheel and nut the valve is opened or shut, and by it also the point of cut-off is regulated. The spindle, *b*, is screwed into the valve, and both are prevented from revolving by a flat rib, which is cast on the under side of the valve cover, a similar rib being formed on the valve, and with which the rib on the cover engages. On the extreme end of the spindle is a nut, *d*, which keeps the hand wheel and nut in the position in which it is set. This nut also serves a second purpose, that of a lubricator, being fitted as an oil cup. The brass, *c*, is turned with grooves and forms a thrust bearing for the upper part of the sphere in a manner similar to that adopted for screw propeller shafts. The ribs of this brass work in corresponding grooves in the metal cap, which encircles them, and to which the upper portion of the brass sphere is attached. The base of the elastic sphere is attached to a sleeve, *e*, which is made in one with the pulley, over which a gut band from the crank shaft of the engine passes, and which gives rotation to the ball. The sleeve *e*, revolves freely upon the fixed portion, *f*, of the valve casing, and is prevented from rising upon it by a collar, which is fixed by a side screw to the end of *f*.

The arrangement illustrated is one in which the central spindle is connected direct to an ordinary double beat or equilibrium valve, *g*. The governor, however, may be made to operate on any other kind of throttle valve, and can be fitted to existing engines It will be seen that when the ball is put into revolution, the centrifugal force causes the poles to approach each other. As, however, the lower pole is confined to the same horizontal plane, the whole vertical motion occurs at the upper pole, and depresses the spindle and closes the throttle valve to a corresponding extent.

As a marine governor this apparatus seems especially suitable, being unaffected by the rolling or pitching of the vessel. Mr. Bourne has succeeded in producing an efficient, compact, and elegant apparatus, which will doubtless come into extensive use. It adds one more testimony to his ingenuity and mechanical ability, and like the rest of his inventions is based upon correct and sound principles.

The rolling mills at San Francisco, which have been in operation two and a half years, use 400 tuns of iron monthly, turning out 230 tuns of finished iron, of which ninety tuns consist of rails. Besides railroad iron they have been turning out car axles, spikes, shoe shapes, and general railroad work

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NEW YORK, SATURDAY, NOVEMBER 19, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

HOW LONG SHALL NITRO-GLYCERIN CONTINUE ITS WORK OF DESTRUCTION?—THE FAIRPORT EXPLOSION.

We have been taught from early infancy that human life is of all earthly things most sacred and valuable. The Scriptures tell us the greatest evidence of love a man can manifest is to give his life for that of his friend. Yet in these latter days we seem to have adopted a new gospel, by which the pecuniary interests of corporations and unscrupulous and avaricious men, are set higher in the scale of value than the lives of innocent, industrious people, and the happiness of families.

Since the first introduction as an explosive agent of that most terrible compound, nitro-glycerin, its history has been one of disaster and destruction. The calamities, of which it has been the cause, are too horrible to dwell upon, even in the recollection. It is our painful duty to now record still another, and we copy the following brief account of it from the Painesville (Ohio) *Telegraph*. The explosion took place at Fairport, Ohio, on Tuesday the 1st inst.

"At about 5 o'clock the people of Painesville were startled by a sudden concussion of the doors and windows, and jarring of buildings, as though some heavy body had been hurled against them, with a force almost sufficient to crush them in. This was followed by a dull heavy reverberation, similar, yet still unlike, the firing of heavy guns at a distance. Buildings were jarred, and trembled as though shaken by an earthquake. The reverberation and rolling sound as of distant thunder were perceptible at least from three to five minutes after the first concussion was felt. An immense cloud of blood-red smoke was seen to arise in the direction of Fairport, and then to change its color to a lighter hue, and spread itself out in the heavens. This terrible phenomenon at once seemed to explain the cause of the great commotion. All at once understood that it was either the explosion of the nitro-glycerin manufactory or their magazines. Teams were immediately brought into requisition, and a number of our citizens started for the scene. It would be impossible to describe the scene which the town presented. The whole place seemed at first a complete mass of ruins. The buildings were shattered, the doors blown off their hinges, the windows all smashed in, plastering off, crockery, lamps, and looking-glasses demolished, chimneys torn down, stoves overturned, and everything in the houses in utter chaos. But if the scene was terrible within, it was still more so without. The whole population nearly were in the street, wild and crazed. The crash had come so suddenly, and the concussion had been so great, that many of them for the time were perfectly insane. Some of the men were for a few moments attacking each other, and women were insanely struggling, while all were loudly weeping and wailing. Children were running wildly about, screaming in terror, as if seeking protection, while others were struggling and screaming in the arms of their mothers, who were rushing hither and thither, not knowing what to do or where to go.

"Both the magazines of the Glycerin Company, situated on the west side of the river, had exploded, and four men who were at work in or near them were blown to atoms. The immediate cause of the explosion is not and never will be known. It is supposed that Mr. Malone, one of the four men, was digging a pit for a new magazine, and that one of the men was engaged in putting glycerin into cans from the jars in the magazine ready for shipping, while the other two were in some way assisting, by carrying glycerin backward and forward between the magazines and the manufactory. The explosion of the two magazines, which were near each other, was simultaneous, so far as the people in the vicinity could judge, they hearing but a single report. The men were blown to atoms. So far as we have heard only one piece of flesh has been found, not larger than a man's hand, and a bone, apparently part of a rib.

"The effect upon the magazines was wonderful. Of the frame structures only a handful of splinters was anywhere to be seen. It seems as if the wood must have been consumed, or the pieces blown so far that no one has yet found them. The force of the explosion penetrated deep into the earth, heaving out immense quantities of sand, and below this huge masses of blue clay. The holes, which must have been blown out to the depth of fifty or sixty feet, soon filled with water up to the level of the lake. They are forty or fifty feet in diameter at the top, and seem like the craters of extinct volcanoes. Two or three sycamore trees, which stood near the magazines, were scathed and rent, limbs were wrenched off, and all covered with sand and blackened, as if swept by a fiery tornado.

"The explosion was felt even in Buffalo, a distance of 160 miles. Soon after it occurred, a dispatch was sent over the wires from that city to Cleveland, and other points on the lake shore, asking if they had been again visited by an earthquake.

In Painsville, the shock was very severe, especially in the south part of the town, where the clay or hard pan comes very near the surface. In one small house we have heard of, things were thrown from the shelves, and a bedstead moved near two feet. It is supposed that the explosion must have reached the clay or hard pan, some thirty feet below the magazine, with such force, that houses built on that strata, though some miles distant, were more affected than those on the sand much nearer."

In addition to the above particulars, we have received, through private sources, others, some of which show in a most startling manner the appalling force of nitro-glycerin.

We are told that a physician riding at a distance of not less than twelve miles from the scene of the disaster was stunned by the shock, and his horse brought to a stand-still. Upon looking at his watch he found that the concussion had stopped it.

Another man sick with typhoid fever, lying two miles from the magazine, was instantly killed by the shock.

There is something intensely awful in the contemplation of a force like this, which, held by a slender and feeble thread, will, when let loose, rend the air like an earthquake and scatter destruction for miles around.

Since the introduction of nitro-glycerin to this country we have more than once raised our voice in denunciation of it as a far too dangerous substance to be allowed to exist in larger quantities than a chemical professor would venture to exhibit to his class. Experience has shown that it may, and will explode under the most ordinary circumstances which attend its storage and transport, and that it cannot with safety be intrusted to the handling of such men as must use it, if used at all, for purposes of ordinary blasting. The damage done by it has far exceeded any good derived from its use, and it is time, and more than time, that its record of death should be terminated by stringent laws prohibiting its general use.

ROADS AND ROAD-MAKING.

Of primary importance to the civil as well as military power of any country are good public thoroughfares. Rapidity and cheapness in transportation are vital necessities to commercial prosperity, and in time of war the safety of a nation may depend upon the state of her roads. These facts have long been recognized, and hence the perfection of roads has been a problem to which engineers have in all ages assiduously applied themselves. The importance of even a slight advance in improvement has kept alive interest in this department of engineering, and century after century has elapsed without the perfect ideal being considered as yet reached.

That this is true is proved by a very brief review of the Patent Office records, in which patents for various compositions for road surfaces, and for methods of road-building, constitute every year a notable number of the patents applied for and issued.

Probably the most remarkable success ever yet achieved by any one system was that which attended and still attends the macadam road. Notwithstanding its expensive character, it to-day covers more surface in Europe than any other. In America, except in the vicinity of large towns, this road is not much employed, the comparative sparseness of the population and the small amount of travel in rural districts not warranting the cost of its construction and maintenance.

There are few circumstances under which this road is not admirably adapted to town and country thoroughfares. It has a smooth surface, after it has been a little used, and affords an admirable foothold for horses. It is expeditiously laid, and perhaps demands as little expense for care and maintenance as any other capable of equal endurance and service.

It is now fifty years or thereabouts since Macadam introduced this celebrated system, and it is quite doubtful whether the next fifty years will give the world anything better for all purposes. But, as we have already said, this system is not at the present, nor is it probable that it soon will be, available for the greater part of American thoroughfares.

Roads in this country must, from the nature of the case, be constructed of such materials as are available immediately along their lines, and must necessarily be more or less im perfect.

In this as in other countries the great enemy of roads is frost, and the only way to even partially prevent its ravages is to construct roads high enough to allow thorough drain age. The flat surfaces permitted on most roads in this coun try is their most radical defect. The result is rivers of mud in spring and autumn, and frozen ruts of indescribable ugliness and discomfort in winter until such time as the snow covers and fills them.

A few days' labor devoted to thorough ditching along the sides of roads and elevating the centers where they have settled below the proper grade would greatly mitigate the evils complained of. This is generally done, when done at all, by throwing back on the road the soil excavated from the ditches, a very erroneous method and almost a sheer waste of labor. Such soil is generally composed of comminuted and pulverized material washed off from the road, and will only temporarily pack. As soon as it becomes very dry in summer it grinds up into a dust heap, and is blown off by winds, and washed off again by rains.

All soil used to raise the level of roads should be new soil, not the washings of the roads, which latter should be carted away. Where roads are much traveled these washings are a valuable manure, and it would pay well to cart them into the lands lying along such roads, from which soil of inferior fertility might be taken to form the roadways.

Wherever practicable, a deep hard bed of stone or timber should be laid below the reach of frost, upon which the surface material should be distributed. Gravel stands unrivaled for road surfaces, but it is not available in many localities. Broken stone, however, is obtainable oftentimes where gravel cannot be got, and answers the purpose very well.

We have seen a road laid through a swamp made with a bed of rough logs, well sunk down, and covered with a mixture of blue clay and broken stone, which was excellent in all respects, having almost as good and permanent a surface as macadam.

It is usual to work country roads early in the summer, to repair the defects caused by spring upheavals. This done, they are generally left till the ensuing season, when the same operation is repeated. But a little labor late in the fall would pay well on most roads. This labor should be expended in securing proper drainage. All sluices should be opened if stopped, the roads raised where the summer wear and tear have depressed them, and their surfaces made smooth, so that the water may run off with the utmost facility. Neglect in these particulars is always dearly paid for in the miring of teams and wagons, and in wear and tear of both animals and vehicles.

THE MOTIVE POWER OF EXPANDING GASES.

The power of expanding gases to perform work has only been successfully applied in the use of steam or water-gas, and atmospheric air. In the use of these gases they are allowed to escape after having expended a portion of their heat in the performance of work, and escaping to carry with them a portion of the heat imparted to them. In condensing steam engines, a portion of this heat is recovered and sent back to the boiler in the feed water, but a considerable loss is nevertheless experienced.

The general belief has been that fluids capable of being changed into gases by the action of heat, are more applicable to motive purposes than permanent gases. And we have yet to be convinced that this belief is not scientifically correct. It is true that the heat expended in converting water into steam at 212° is, and cannot be otherwise than lost in working steam under ordinary atmospheric pressure, in non-condensing engines; but this loss is so far compensated for by the conveniences attending its use, as contrasted with that of permanent gases, that it still maintains, and seems likely to maintain its supremacy.

Notwithstanding this, numerous attempts have been made and are still making by able engineers, to substitute permanent gases for steam in the working of engines. For the most part, air is the material employed, and it is with this material that the greatest success has been acheived. It has been used both separately and in combination with steam In the latter method, no very remarkable and permanent success has been reached, though some attempts in this direction have seemed to promise something.

With air used singly, there are now several engines, popularly known as "Caloric engines," which are efficient, safe, and economical within certain limits of power; but all attempts to develop great power with a single motor have failed up to the present time. With this brief review of the past and present history of invention in this field, we may proceed to notice an attempt recently made by Mr. A. W Bickerton, F. C. S. associate of the Royal School of Mines, who, in a paper presented to the British Association recently, gave an account of his invention.

Without admitting that the claims for economy made by him are probable or even possible, we think the statement made in his paper will interest our readers, and, therefore, will

close this article with an abstract from it, which gives the principal features of his invention.

Crude nitrogen gas is heated in a serpentine system of tubes until the pressure is double that of the air. It is then admitted into a cylinder in which it presses forward a piston, and is allowed to expand. Next it passes into an apparatus where it is cooled, and consequently diminished to half its bulk. The cooling is effected in a new arrangement, which is so constructed that the whole of the heat above that of the external air is transferred to an equivalent volume of air passing in an opposite direction. This heated air is then used as a blast for the fire, $\frac{1}{16}$ going to the hearth of the furnace through a tweer, and $\frac{1}{16}$ mixing with the products of combustion immediately above the fire, so as to complete any imperfect combustion, and also to modify the temperature of the whole mass, so that it may not be likely to injure the iron of the gas tubes, and the remaining $\frac{5}{16}$ being introduced into the system at a point further on. The construction of the system of tubes is such that, by the time the products of combustion reach the open air, they shall have parted with nearly all their heat, and transferred it to the nitrogen contained in the tubes, and hence a chimney draft cannot be used, and the blast has to be produced by a blowing engine. The nitrogen, after having been cooled to half the volume it occupied in the cylinder, is then compressed and forced into the system of tubes at the point furthest from the fire. If this forcing the gas back again into the system of heating tubes appears absurd, it must be remembered that the gas while leaving the heating tubes occupies twice the space it does when being forced back, hence it fills a cylinder of twice the area, and the force that may not be disposed of is equal to half the pressure exerted in the larger cylinder. But the other half of the power is not lost, it is simply conveyed back to the heating tube, and is used again. The losses that arise are those incidental to all engines, such as radiation, conduction, the enormous loss of heat that usually goes up the chimney, together with the still greater loss that is constantly being carried away by the condensed water is avoided—an amount in itself six times as great as that converted into work in the steam engine. The inventor expects his new heat engine to convert 60 per cent of the heat of combustion into work, a duty that is fully 500 per cent above that of well-constructed steam engines.

TIME AND DISTANCE.

At the very bottom of all exact science lies a just conception of time and distance. It may be said that no such thing as an exact science could possibly exist without the ability to accurately measure these relations. In the science of mechanics and its application to practical work, in the shop, and manufactory, they are both fundamental in importance. The terms, speed, velocity, rate, etc., all express the relations of time and distance, and the measure of power to perform work is a definite number of foot-pounds raised per minute.

The unit of work is one pound raised one foot without regard to the time employed in the elevation. The term work, then, does not include the idea of definite time, while the term power does.

This distinction is of primary importance to the correct conception of the laws of applied mechanics. Work is the overcoming of any resistance, whether the time occupied in its accomplishment be long or short. Mechanical power is that which can perform work or overcome resistance in definite time, whether the power be strength of men or horses, the fall of water, or the expansion of steam.

When we attempt, however, to conceive of time and distance we can set no limit to either; they expand to an illimitable extent. We are obliged to conceive of time only as the relation of the succession of events, and of distance as the relation of position. In the measurement of time, we adopt as the unit the interval between two events which succeed each other at uniform intervals. The oscillations of pendulums of uniform length, in the same position upon the surface of the earth are found by experiment, and may be mathematically demonstrated, to succeed each other with perfect uniformity of interval. The rotations of the earth upon its axis also practically succeed each other at uniform intervals. Thus we have both an artificial and a natural standard of time.

From natural standards of distance may be derived artificial ones, and standards of time—as the length of a pendulum oscillating seconds—may be made to correct standards of distance or length. From these two standards may be derived all other measures whatever they may be.

Few have anything like an appreciation of the vast importance of accurate measurement in the natural sciences. But such measurements are all based on time and distance. All weights are primarily derived from measurements of distance, and it follows that all estimation of magnitude, density, hardness, or any other physical property measured by pressure or weight may be referred back to measurement of distance.

It is therefore in and through the consideration of these relations that we gage all our sensations of external things. For size, intensity of color, and light, form, weight, and temperature, all are estimated, and conceived only through some application of these relations. Deprive the mind of any means whereby it may estimate or imagine the distance of a body from the eye, and it can form no conception of magnitude, and it is only by comparison of relative distances of parts from each other that it can conceive form. It is true that form also depends upon direction of outline, but direction is not apparent without extent or distance, and hence this consideration does not invalidate the foregoing proposition.

Even our knowledge—in so far as we have any—of the molecular constitution of masses is obtained in great part through the application of these relations. The definite weights in which chemical combination takes place is only an expression of definite bulks, or volumes, established by measure.

These relations are types of that in which all human knowledge consists. We perceive nothing and conceive nothing but relations, and the combination of relations of which the mind takes cognizance are to it the embodiment of all external things. The idea of relation, however, involves the existence of something to be related, and thus the idea of material existence is inferred; but as we cannot go beyond relations in mental operations, the existence of matter can never be made the subject of actual demonstration.

The existence of force is also inferred from change in the relation of distance, and is perhaps as just an inference as that of matter, though in our opinion not so essential to thought. Neither force nor matter can be estimated as entire entities, we can only conceive of them through relations of mass and movement, which are, as we have seen, only measured by the relations of time and distance.

In considering the ideas of matter and force we stand on the very border line which circumscribes thought, but even here, the moment we attempt to relinquish our ideas of time and distance we become lost in a maze from which we may return, but through which we find no pathway for the human intellect to transverse.

RESIGNATION OF COMMISSIONER FISHER.

The following letter will explain itself:

UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., Nov. 8, 1870.

SIR:—I ask permission to renew the tender of my resignation of the office of Commissioner of Patents, made October 24, and temporarily withdrawn at your suggestion. If there be no reason to the contrary I suggest that the resignation be accepted, to take effect at the close of Thursday, November 10th, inst. I have the honor to be, very respectfully, your obedient servant. SAMUEL S. FISHER.

To his Excellency, U. S. Grant, President United States.

Colonel Fisher has been an able, industrious, and conscientious public servant. The labors and reforms which he has introduced will be felt to advantage in the future administration of the Patent Office.

At the time of our going to press no appointment had been made to fill the vacancy. The names of Samuel A. Duncan, Assistant Commissioner of Patents, William Bakewell, patent lawyer, Pittsburgh, Judge Allison, Registrar of the Treasury, T. C. Theaker, Ex-Commissioner of Patents and patentee, Horace Greeley, President of the American Institute, Clinton Rosevelt, scientist and inventor of the panatechner, J. K. Fisher, steam carriages for common roads, Gideon Welles, Ex-Secretary of the Navy, Jonathan Dennis, Quaker and solicitor, E. P. Weston, the great pedestrian, and other well-known names have been mentioned; and that the interests of female inventors may not escape recognition we suggest the name of Elizabeth Cady Stanton.

ATTEMPT TO ABOLISH THE PATENT OFFICE.

A correspondent of the *Tribune* telegraphs from Washington that "a bill will be presented to and pressed on Congress for the abolition of the Patent Office Bureau. This office has, it is alleged, become too complicated to be beneficial and must either be abolished or have its jurisdiction materially changed."

A correspondent who has noticed this paragraph inquires "Whether if Congress should abolish the Patent Office it would cancel all unexpired patents."

We answer No. If the Patent Office should be abolished now or hereafter it could not affect patents issued before the act of abolishment went into effect. At present there is no likelihood that any such act can be got through.

A Successful Inventor.

Freeman Talbot, of Rockfield, Minn., writes: "I should have acknowledged the receipt of my patent before this were it not that I have been away from home for the last two weeks. During that time I have made more than three times what the patent cost me, and the future looks bright.

"I do not propose to take out more than forty patents more, and would here remind the eager aspirants for my patronage that the able, reliable, long-established, and world-renowned firm of Munn & Co., 37 Park Row, N. Y., are quite capable of doing all my business with the Patent Office to my entire satisfaction; and I am, from a sense of duty to my family and of gratitude to you, obliged to refuse the kind offers of those individuals and companies that have already offered their services."

A Veteran Inventor.

I. S. Clough, of this city, and who by the way is a true philosopher, writes to us as follows: "Promptness in business is one of the most prosperous traits for business men. I have to thank you again for your successful manner of application for a patent, you having taken out several for me since 1849—the last one on a complete ash-sifter, which I applied to you to procure for me on the 5th of October, and on the 13th I received official notice that the patent was allowed. This speaks well for the way the cases are managed at the Patent Office, where they always are much assisted if a finished model in all its parts, showing the benefit of the improvement, is sent with each application. This, with your manner of explaining the same, so truly written out and illustrated, makes all satisfactory and easily understood."

LETTERS FROM THE SOUTH.

COLUMBUS, Ga., Oct. 17, 1870.

Southwestern Georgia—Savannah—Atlantic and Gulf Railroad—Orange Fever—Macon—Columbus—Cotton Factories and Water Power—Railroads.

Southwestern Georgia, of which Columbus is the northern angle, is the great peculior cotton region of the State. The soil is mostly underlaid with rotten limestone. Just here commences the granite range. The land is fertile, but the people are poor, for they depend almost entirely on cotton as a crop, merely entertaining the foolish idea that corn will not grow on their lands. Albany is the center of this section and has its outlet through the Atlantic and Gulf Railroad to Savannah. This railroad traverses for the greater part of its length vast tracts of pine barrens, whence the markets of Savannah and the world are supplied with lumber. They claim to average about three million feet per month. It connects southward with Florida, whence, I am informed, quantities of canned pineapples are brought. It seems that this fruit is brought to Cedar Keys, there put up, and thence sent to Savannah by rail. In the hight of the season as much as two car loads a day are shipped. The saving of sugar by being enabled to use riper fruit is said to be very great. Another article of commerce sent over this road to Savannah and thence to Europe, is black (or sea island) cotton seed for oil making. Of this 500 tuns were sent in six months of 1870. This railroad also connects, via the Macon and Brunswick Railroad, with the to be great city of Brunswick. For fifteen or twenty years the fine harbor has remained almost unimproved except by occasional efforts to bring it into notice. Now it has passed into the hands of Northern capitalists, and if they do not make it in reality what it has been so long in name—a city—it will not be through lack of enterprise and good location. It is already rapidly improving. The M. and B. R.R. has just been finished, and another to Albany and Eufaula is building. The idea is thence to connect westward and make Brunswick the great cotton-shipping port.

The orange fever has raged for some years in Florida with great violence. When put on paper that a tree yields so many oranges, and that there are so many trees to an acre, and each orange worth so much, an immense profit is made out. It is also represented to be a very easy way of making a living. But it must be remembered that it takes years for an orange grove to grow and bear well, and good orange lands near transportation are already taken up, and sell very high, and when hauling comes in profit goes out. As Col. Haines, of the A. and G. R.R., says, "I want the line of my road, and Florida too, settled up by Northern people, but they must not expect to find any place here that they can live without work."

Savannah is a very active place, and has this year largely increased its cotton shipment. The town has a sandy soil and is almost a perfect level. It is supplied with water by pumping to the top of a reservoir tower, from which the water is distributed to the city. The pressure is not very great, but answers amply for the hight of the houses there. A great point of interest in the city is the Cemetery of Bonaventure. It is a rather private affair, but well worth a visit. The evergreen oaks hung with the somber gray moss have a melancholy look, almost an appropriate one. Savannah has no manufactures, if we except some steam and rice mills. Money is worth too much to trade in and to advance it on cotton for manufacturing.

Macon, the great interior cotton mart of the State, is similarly situated, though there was a small cotton factory run by steam, which I was informed had a rather sickly existence—more from bad management than any real permanent cause. This place is at present the great manufacturing town of Georgia, and is likely to be still greater. It is located on the Chattahooche river, which, three miles above, commences a series of falls that end near the middle of the town. From thence the river is navigable all the year to the Gulf. The hight of this fall is about 165 feet. On this line there are three factories and one large flour mill. The upper factory, called the Columbus Manufacturing Co., R. H. Chilton, President, owns land up and down the river for a mile, and has a fall of $42\frac{1}{2}$ feet, with water and sites sufficient to run 600,000 spindles. The factory now contains only 4,000 spindles and 96 looms. The pickers and cards are English, the rest American machinery.

Next below and in the limits of the town is the Muscogee Factory, running 4,000 spindles and 60 looms. The building is not full. The looms and spindles are American, the cards English.

The other mill is the Eagle and Phœnix, and is the largest in the South, having lately been enlarged. As it has a wide-spread reputation not only for the character of its goods, and its good management, but also from its using in so great measure English machinery, I will notice it more fully. The power used is in each mill or building—two double Leffel turbines, 56 inches in diameter. Other wheels in each drive the pickers, and one stands ready to drive a fire pump. Another 40-inch wheel drives the workshop machinery. Hight of fall is 14 feet. The two mill houses are 220×57, and five stories high. The picker room is 80×40, and three stories high. The finishing room is 120×40 feet. The dyehouse is 120×40; and the machine shop 54×50. The office and ware-room building is 124×40, and two stories high.

They run 18,000 cotton spindles and 2,000 woolen spindles, All the woolen and about two thirds the cotton spindles are American. Of the looms, 8 run on cotton blankets, and 60 on woolen goods; 186 are American, and 350 are English. Of the American looms they have nearly every make, and endeavor to use every new improvement that promises to be valuable. An experienced Glasgow dyer does their work in that line.

I asked as to the value of the English machinery compared

with the American. The general superintendent, Mr. Young, was decidedly in favor of the English. He thought the looms did far more work, could be run at higher speed, and the spindles would do just as much. He did not believe in the ring-traveler, but would stick to the old English throstle. I asked the foreman of the spinning rooms his opinion. He said the American ring-traveler would do nearly or quite one fifth more than the throstle, but for high numbers of yarns the throstle did best.

Mr. Young gave me a history of his experience in cotton manufacturing in Georgia. He said years ago while he was keeping a country store, a man came along with a wagon-load of spun yarns and wanted to sell it to him. "Why, I told him, the country people wouldn't buy his factory-made thread—every woman in the country had a spinning wheel. He insisted on leaving it with me, and said if I did not sell it he would take it back. Three months after he came along, and I had not only sold all but needed more. That was about the first factory-spun yarn sold in Georgia." Previous to the war there were thirty-three cotton and woolen factories in the State; now there are twenty-five—some not rebuilt.

In the loom rooms, I was told, they could get 50 yards per day from the English loom, and about 40 from the American. The American spindle, running on ordinary yarns, made from 5 to 5¼, the English 4 to 4½ ounces of yarn per spindle per day.

This factory uses a little over 3,000 bales of cotton a year and nearly 200,000 pounds of wool. The wool is almost entirely drawn from So. W. Georgia. Their cotton blankets are a specialty and peculiar to them in this country; they get their idea from France. The factory was erected by Capt. U. J. McAllister, who has made many improvements in machinery, and, as he told me, always got them patented through the Scientific American Patent Agency.

These mills are an example of what the people of the South can do if they choose. They have a capital all paid in of $1,250,000, of which only $125,000 is from the North. Mill No. 1 paid a dividend of 18 per cent in 1868; in 1869, mill No. 2 was commenced, and has but lately been finished and filled with machinery. Two mills located here were burned during the war. The Company own other fine water powers, and with the same enterprise may treble their capacity.

Columbus is destined to be the great manufacturing place of the South. There is no such water power elsewhere, and nowhere else such ease of transportation. Then, too, it is in the midst of a fine cotton-growing region, and shipped last year over 75,000 bales of cotton. I asked the cost of manufacturing here compared with the North, but did not get a satisfactory answer. It was evident they did not desire to tell. Yet there is at least the difference in the price of cotton, and the difference of transportation and cheaper labor. In a pamphlet issued by General Chilton, he claims that it costs $22 more to manufacture 500 pounds of cotton in Massachusetts than at Columbus—all charges and freights included. Labor is abundant, there being hundreds of poor whites anxious to get such work. General Chilton told me he had to turn them off daily.

There are three more cotton factories in the adjoining county of Upson, running about 7,000 spindles in all. In Columbus there are two large founderies and machine shops, and one agricultural implement manufactory; also near by, is Ennis' Novelty Wood Works, for spokes, hubs, etc., and patent wheelbarrows.

A railroad in Alabama will soon connect the town with the Alabama coal fields, and another southwards to Bainbridge, will give rapid and better communication to Savannah *via*. A. & G. R. R.

Coal is now brought from Tennessee. The town is supplied with gas made from wood. It has no water works, but John E. Birkenbine, of Philadelphia, was there to examine localities, and report on the possibility of erecting suitable works. It is one of the needs of the place, especially as it will have a large manufacturing population, and should be well supplied with water. Good water can readily be had from the hill north of the town. H. E. C.

Nerve Telegraphs.

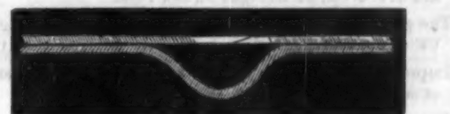
Within the flesh or muscular part of the body are two distinct sets of nerves, namely, the motor and the sensory nerves. By the sensory nerves the brain receives intelligence of all outward actions, and the mind becomes conscious of external things, such as light, scent, sound, taste, and touch, of pain or pleasure. The motor nerves, on the other hand, convey the intelligence or will of the mind from the brain to the outward world, by directing the muscular motion. If the brain desires the hand to strike the strings of a harp, it does so by the motor nerves; but the sound which is returned is conveyed to the brain by the sensory nerves. Intelligence from the brain to any part of the body, and conversely, is conveyed by the nerves at a velocity of 112 feet per second; that is, at a speed of one mile in 47 seconds. Quick as this may appear, the time between a wound given and the pain felt is appreciated. By what means the mind or will acts over the nerves we are unable to say. Persons who have what is figurately termed "an iron will" can endure pain with almost stoic indifference. Neither tears nor laughter seem to move them. Others there are who have so little command over their nerves that trivial things affect them greatly. To train the mind to exercise its will over the nervous system is highly beneficial.—*S. Piesse.*

Fire-Arms in Turkey.

The *Levant Herald* says the Porte has decided upon converting a large number of the Springfield and Enfield rifles into Remingtons, and several thousand breech-pieces on this latter system have been purchased in Vienna. As soon as the conversion has been effected the new arms will be served out to portions of various regiments with a view to test their practical value on a large scale. The military and naval preparations are being pushed on at Tophaneh, Zeitounbournou, and in the arsenal, in all three of which large numbers of hands are working extra time. In addition to the arms and munitions which are being rapidly manufactured in these establishments, a considerable contract for cannon on Krupp's system has been given to a house in Vienna, whence several batteries of mitrailleuses have also been ordered, in addition to those already purchased in Belgium and America.

BRAZING BAND SAWS.

A correspondent of the *English Mechanic*, gives the following directions for brazing band saws: 1. Make a splice with a file on flat way of saw, the length of two teeth. 2. Get a



piece of flat iron, and bend it into the same shape as in the diagram, and with some small binding wire bind the saw perfectly straight and firm to the flat iron, so that the splice may come directly over the curve. 3. Wet the splice with clean water and rub on some powdered borax. 4. Make a stiff paste with spelter and borax mixed with water. Take a piece the size of a small nut and lay on top of splice. Put the splice between two pieces of charcoal and with a blowpipe direct a steady flame from a gas-jet on the paste.

TAX OF TRANSPORTATION.—The country that exports the commodity of smallest bulk, is almost wholly freed from the exhausting tax of transportation. At Havre—ships being little needed for the outward voyage, while ships abound—the outward freights must be always very low. France, in 1856, exported silks and cloths, clothing, paper, and articles of furniture, to the extent of $300,000,000; and yet the total weight was short of fifty thousand tuns—requiring for its transport but forty ships of moderate size, and the services of perhaps two thousand persons.—*Carey.*

TRADE-MARKS AND DESIGNS.—Some of our prominent manufacturers have just discovered the existence of the new law, which authorizes foreigners to patent their trade-marks and designs, and find that it will seriously cripple their right to continue the practice of copying designs of foreign carpets, delaines, and other stuff goods. We are assured that a powerful effort will be made at the next session of Congress to repeal this law; therefore it behooves those who wish to protect their designs to do so at once. If the law should be repealed it cannot affect existing design and trade-mark patents.

EXTENSIVE SALT DEPOSIT NEAR BERLIN.—The boring at Sperenberg, near the city of Berlin, about twenty-five miles to the south, had reached, on the first of June last, a depth of 3,090 feet, and for 2,810 feet is through a bed of rock salt. How much deeper the deposit is remains to be tested by further boring. The deposit appears to be quite as rich as the famous Stassfurt mines.

THE only shot tower in New England is, it is said, at Newport. This tower is 150 feet high. The lead is melted at the top of the tower and falls through sieves, cooling in drops of different sizes as it falls, which are caught by sieves of different sizes, and thus sorted for use.

THERE are now ten establishments in Missouri engaged in making pig iron, with a capacity of making 300 tuns of iron per day. Four of these establishments are situated in South St. Louis, three near the line of the South Pacific Railroad, and the remainder on the line of the Iron Mountain Railroad.

QUERIES.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]

1.—IRON CASTINGS.—I have a difficulty to get my iron castings solid on the side which is uppermost in casting; would some brother molder give me a little advice as to the cause and remedy, and oblige?—A Young Molder.

2.—BLACK JAPAN.—Can you inform me how the pitch is prepared that is used in making black japan, and also how the japan is made, so that when put on a coach panel and varnished it does not turn green?—H. W. R.

3.—WATER COLORS.—Will some reader inform me how the liquid water colors in bottles are made; also how the moist water colors in pans are made?—W. C. C.

4.—POWER OF ENGINE.—Would any reader let me know, through the medium of your journal, the pressure necessary to drive a fourteen horse-power high-pressure engine to work at its nominal power and how many revolutions per minute should it go?—J. B.

5.—LACKERS.—Will some obliging reader who is acquainted with lackering give me the recipes for making a good gold lacker, a good green lacker for bronzing, and a pale, colorless lacker?—Indicator.

6.—SILVERING CHEAP LOOKING LOOKING-GLASSES.—Can any of your readers tell me the way to silver cheap looking-glasses? also the materials required, and method of using? Having some pieces of glass that I want silvered for a particular purpose I should like to try and do it myself.—A. M.

7.—CHEMICAL AND BREWING.—The water I use for brewing contains a large quantity of iron. How can I get rid of this iron in the water? It prevents the beer getting bright. Would a filter of animal charcoal, vegetable charcoal, and gypsum do? I want some sort of filter which will ex act the iron without damaging the water in other respects.—Brewer.

8.—REMOVING PAINT AND TAR.—How can I remove oil paint and tar from oil-cloths, tarpaulins, and other fabrics, so as to obtain the body cloth intact? Can some kind reader oblige?—Old Tar.

9.—THE BIRD AND THE BAT.—Will any of your readers inform me of the mechanical principles involved in the flight of the bird and the bat, and also wherein the difference between the two modes consists, or refer me to any work in which I might find such information.—T. R.

10.—WHITE LIGHT.—I am greatly in need of an artificial white light, one by which I can distinguish shades of color; not required to be intense but regular, and moderate in cost first and second. Is there any plan of taking the yellow out of gas or any other artificial light? I have tried tinted glasses for correction, but they do not answer.—J. O. R.

11.—CONTRACTION AND EXPANSION OF METALS.—If iron be heated and plunged into cold water it becomes hard and contracts, but if copper be heated and plunged into cold water it becomes soft. How is this accounted for? It seems a contradiction of the general law, viz., that all bodies expand by heat and contract by cold.—A. C. S.

12.—SOLDERING BRASS TUBES.—Will some reader tell me how to join thin brass tubes without the application of heat?—W. H. D.

13.—DRY COLORS.—I should feel obliged if some of your subscribers will inform me how to make dry colors, such as greens and blues, etc., or name a work which will give the information; also the best work on varnish making.—H. J. D.

14.—A COTTON SPINNER'S DIFFICULTY.—Would any of your readers in the cotton district help a brother spinner out of a difficulty? I have to work a double beater scutcher, and the cotton will stick to the last beater blades, and when it gets on to one side takes all the draft from the other, and so causes one part to choke and make a bad lap. I know there are plenty of books giving instructions as to calculations, but every one who is in the trade knows that to be a very small part of cotton spinning.—Workman.

15.—DRY PLATE PROCESS.—Will some photographic reader furnish me with the formula and manipulation of one of the best dry plate processes for a novice in the art to commence with?—A Would-be Photographer.

16.—ENGINEERING ESTABLISHMENTS.—Will some subscriber please state what engineering works employ the largest number of hands, and state the number of hands employed by several of the largest works in the world?—Draftsman.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

W. R. J. answers the inquiry of I. D., in re ard to coloring butter, and preserving eggs. He recommends for coloring butter the juice of fresh carrots, or annotta, but gives no definite directions for the use of these materials. He says eggs may be kept by packing them in salt or bran point downward. He further says W. H. L. can get rid of red ants by sprinkling sugar on a coarse or very porous sponge. The ants will enter the cavities of the sponge to get the sugar, and being thus trapped they may be killed by immersing the sponge in hot water. The sponge may be used repeatedly in this way till the pests are removed The more sponges used the more rapid will the extermination proceed M. W., of Passaic, N. J., also recommends this plan.

Dr. T. A. H., of Ill., says red ants will not frequent a place where heavy coal oil has been smeared. A ring of this substance placed around a sugar barrel will, he says, protect the contents from the ants. Will he tell us whether the odor will not impregnate the sugar? He also recommends the method for keeping eggs given by W. K. J., of Illinois, but adds that it is important to keep them where the temperature does not rise above 50° nor fall lower than 32°.

R. L. C., of W. Va.—Birdlime may be made by boiling linseed oil over a slow fire till it is very thick and glutinous. Its adhesiveness may be proved by trial with the fingers. You will need to use much care not to burn it, and the vessel employed should not be more than one third full of oil. When sufficiently boiled pour it out into cold water. It is considered best to make it thicker than is actually necessary for use, and to bring it back to the proper consistency by mixing it with pine tar.

A. D. G., of Mass.—The theory in regard to the effect on health of the evaporation of water on heaters and stoves, is that the capacity of air to hold moisture is increased by heat, and that if not supplied in the manner alluded to it will seize moisture from the mucus membranes of the nose, throat, and lungs, irritating them, and rendering them unhealthy and susceptible to effect of atmospheric changes.

E. B., of Ill., says red ants may be exterminated by using a solution of one tablespoonful of tartar emetic in a pint of water. This placed where the ants can get it will, he says, prevent all further annoyance from them. Tartar emetic is, however, a deadly poison, and should, if used at all, be used with extreme caution.

G. R., of Mo.—The dark color of the steam escaping from the safety-valve of the boiler of which you speak, was probably due to the violent priming of the boiler. It is obviously impossible to give an intelligent opinion as to the primary cause of the explosion, without a personal inspection of the boiler, and full knowledge of the attendant circumstances.

E. G. P., of Mass., replies to R. L., of La., that he finds no better recipe for welding steel, than extensive careful practice. With that and a clean slow fire, and a liberal amount of borax, he finds no difficulty in welding steel to steel though it be hard and "rich in carbon."

W. H. A., of Tenn.—To join together pieces of tortoise shell, dress down the edges to a nice, true bevel, then lap them together and press them between hot iron plates. In practical working, tongs with long flat jaws are used for this purpose.

H. F., of Conn.—Rules for calculating diameters of speed pulleys are given in Fairbairn's "Mechanism and Machinery of Transmission," published by Henry Carey Baird, 406 Walnut Street, Philadelphia.

S. P., of N. Y.—After oil cloth has been well washed and is quite dry from water, it should be brushed over with beeswax, very slightly moistened with turpentine, then well polished with a polishing brush. Don't use soap and water—soap dissolves the oil.

J. A. C., of Md.—In our opinion borax and sal ammoniac constitute as good a flux in welding steel as any of the vended receipts.

J. H. E., of Iowa.—Our files contain all the information you seek on the subject of stained glass. We do not wish to repeat what we have said on this subject at present.

N. L., of N. Y.—No valuable information is conveyed in your article upon astronomy, therefore we cannot publish it.

W. M. W., of Ohio, wishes to know if cast iron can be hardened so as to retain its hardness after he ti

D. D. V., of Ill.—Copal varnish of the finest quality may be used on polished steel. It will not attack the metal.

W. E H., of Ct.—We have not published recently any article of the kind to which you refer

Inventions Examined at the Patent Office.—Inventors can have a careful search made at the Patent Office into the novelty of their inventions, and receive a report in writing as to the probable success of the application. Send sketch and description by mail, inclosing fee of $5 Address MUNN & CO. 37 Park Row New York

Caveats are desirable if an inventor is not fully prepared to apply for a patent. A Caveat affords protection for one year against the issue of a patent to another for the same invention. Patent Office fee on filing a Caveat, $10. Agency charge for preparing and filing the documents from $10 to $12. Address MUNN & CO., 37 Park Row, New York.

The Dollar Steam Engine

Which we noticed and gave full-sized illustration of last week, proves one of the most taking inventions of the age. It is wonderfully ingenious, instructive, and amusing to children of all ages, from 7 to 77 years, and will be sent, prepaid, by mail, on receipt of $1·26, by Colby Bros. & Co., 508 Broadway, New York.

Geo. P. Rowell & Co.'s

40 Park Row, New York, Advertising Agents, is a model business house. They give more for the money than any other house in the world.—[City Item, Philadelphia.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

The First Premium for the Best Tin-lined Lead Pipe was awarded by the late American Institute Fair to the Colwells, Shaw & Willard M. F. G. Co., No. 213 Center st., New York.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line.

Improved Foot Lathes. Many a reader of this paper has one of them. Catalogues free. N. H. Baldwin, Laconia, N. H.

Foreman Machinist wanted. See advertisement.

James Jenks, Detroit, Mich., is agent for the celebrated Lathes and Drills made at the Thomas Iron Works, Worcester, Mass.

Steam Gages, cheap, accurate, & durable.—Dealers and Engine builders supplied at lower rates than by any other maker. Every Gage warranted for one year from date of purchase by user. Written warranty given. New Price List on application. R. H. Norris & Co., Paterson, N.J.

It will be noticed that the Messrs. Smith, manufacturers of the American Organ, have their "say" in our advertising columns.

Engineering, Manufacturing, & Building.—Read "The Technologist," the great Industrial Monthly, 40 pages, $2 a year, single copies 20c.; back numbers supplied. Address Theo. B. Thieler, "Technologist," 176 Broadway, New York.

Write Thomas Iron Works, Worcester, Mass., for Index Milling Machines.

Platinum Wire and Plate, of best quality, imported and for sale by S. S. White, 709 Broadway, New York.

Peck's patent drop press. For circulars, address the sole manufacturers, Milo Peck & Co., New Haven, Ct.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

A Superintendent in the Machinists' Tool & Jobbing business will take a position in the U. S. or Canada, on any work. Understands making and running machinery for working iron or steel, hot or cold. Responsible parties address, with particulars, A Mechanic, Boston, Mass.

Lighting Gas in Streets, Factories, etc., with Bartlett's Patent Torch saves great expense, all risks, etc. It is being adopted everywhere. Address J. W. Bartlett, 569 Broadway, New York.

Self-testing Steam Gage. The only reliable Steam Gage. Send for circular. E. H. Ashcroft, Boston, Mass.

Combined Boring and Mortising Machine—Bores and mortises at one operation. In constant use for several years, at our own works. Satisfaction guaranteed. Price $150. The Allen works, cor. Jay and Plymouth sts., Brooklyn, N. Y. Send for circulars.

Low Prices—No Risk—Full Guarantee.—For Price List of Genuine Waltham Watches, which can be sent by express to any part of the country, write to Howard & Co., 785 Broadway, New York, stating you saw this in the Scientific American.

Japanese Paper-ware Spittoons, Wash Basins, Bowls, Pails, Milk Pans, Slop Jars, Chamber Pails, Trays. Perfectly water-proof. Will not break or rust. Send for circulars. Jennings Brothers, 352 Pearl st., N.Y.

Agents Wanted to sell the Star Bevel. It is destined to supersede entirely the old style. R. Hallett & Co., West Meriden, Conn.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

For Fruit-Can Tools, Presses, Dies for all Metals, apply to Mays & Bliss, 118, 120, and 122 Plymouth st., Brooklyn, N. Y. Send for circular.

Practical Treatise on Soluble or Water Glass, just published. Price $3 20, mailed free, by L. & J. W. Feuchtwanger, Chemists and Drug Importers, 55 Cedar st., New York.

Parties in need of small Grey Iron Castings please address Enterprise Manufacturing Co., Philadelphia.

Excelsior Stump Puller & Rock Lifter. T. W. Fay, Camden, N.J

Pictures for the Drawing Room.—Prang's "Lake George," "West Point," "Joy of Autumn," "Prairie Flowers." Just issued. Sold in all Art Stores. "Three Tom Boys." "Bethoven," large and small.

Building Felt (no tar) for inside & out. C.J. Fay, Camden, N. J.

Best Boiler-tube cleaner—A. H. & M. Morse, Franklin, Mass.

The Best Hand Shears and Punches for metal work, as well as the latest improved lathes, and other machinists tools, from entirely new patterns, are manufactured by L. W. Pond, Worcester, Mass. Office 98 Liberty st., New York.

One 60-Horse Locomotive Boiler, used 5 mos., $1,200. Machinery from two 500-tun propellers, and two Martin boilers very low. Wm. D. Andrews & Bro., 414 Water st., New York.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Keuffel & Esser, 116 Fulton st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves.

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventive. No foaming, and does not attack metals of boiler. Price 25 cents per lb. C. D. Fredricks, 587 Broadway, New York

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews Patents in another column.

Incrustations prevented by Winans' Boiler Powder (11 Wall st. New York,) 15 years in use. Beware of frauds.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States Terms $4·00 a year.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

FLOATING VELOCIPEDE.—Wederkinch & Starkweather, Boston, Mass.—This invention relates to a new floating velocipede which can be conveniently operated and readily propelled, and consists in such a construction and combination of a frame, double floats, steering apparatus, and paddle wheel, that the rider straddles the paddle wheel in operating the crank axle of the same.

BRICK PRESS.—John R. Williams, Taunton, Mass.—This invention relates to a new machine for rapidly compressing brick after the same have been formed in another machine, and for thereby making them durable, hard and of equal size. The invention consists, chiefly, in the novel construction of press and carrier, both being arranged to operate automatically and with great rapidity, the carrier serving to feed the press, and also to remove the finished brick.

PISTON PACKING.—John Gates, Portland, Oregon.—The object of this invention is to provide an elastic and steam tight piston packing, which is composed of sectional rings, in such manner that the same may be spread apart by means of an inner spring.

HORSESHOE.—John S. Robertson, Wood End, Scotland.—The object of this invention is to provide an appliance by means of which horses may, in a few minutes, be fitted for encountering ice and snow, and by means of which the feet will be protected, and it consists in a metallic plate attached to the ordinary horseshoe.

LETTER AND PAPER FILE.—Frank W. Whitney, Brooklyn, N. Y.—This invention relates to a new and useful improvement in a file for preserving from damage, and in regular order, letters and other papers, including newspapers, pamphlets, periodicals, etc., and it consists in a succession of springs (more or less in number) attached to a backing of suitable material, and either combined with a book cover or not as may desired.

VENTILATOR.—William F. Ross, Davenport, Iowa.—This invention has for its object to furnish an improved means for ventilating rooms, cars, mines, and other inclosed spaces, with warm or cold fresh air, as may be required, free from dust and other impurities.

STRAW CUTTER.—E. A. Cralle, Jr., Brickland, Va.—This invention has for its object to furnish an improved straw cutter, simple in construction, strong, durable, and effective in operation, doing its work with great ease to the operator.

DITCHING AND GRADING MACHINE.—H. A. Winter, Windsor, Ill.—This invention has for its object to furnish an improved machine for opening ditches, and for grading roads and other places, which shall be simple in construction, inexpensive in manufacture, and effective in operation.

TOPS FOR GAS AND WATER STOP-COCK BOXES.—W. W. Pullis, St. Louis Mo.—This invention has for its object to improve the construction of the tops of gas and water-pipe boxes so as to make them more convenient in use, and which will prevent the possibility of the covers of said boxes being lost or carried off.

BENDING MACHINE.—Joshua Fipps, New Albany, Ind.—This invention relates to improvements in machines for bending wood bars, such as plow handles, and the like, and consists in a combination of a forming block and clamping bar, attached to a suitable frame, and a bending spring and holding apparatus.

SPRINGS.—A. W. McKown, Honesdale, Pa.—This invention relates to improvements in springs for wagons mainly, but applicable for other uses and it consists in a combination of cylindrical india-rubber springs, wood springs, and bars, calculated to form very efficient springs, which may be cheaply made.

LUNCH BOX.—James Elson, Northampton, Mass.—This invention relates to improvements in that class of lunch boxes which are made to resemble books, and it consists in inclosing an inner case of tin, like the said boxes as now made, in another box or case, made of paper, pasteboard, or other like substance, of the same character as the covers of books, by which neater boxes are produced, more nearly resembling books, and better calculated to protect the contents from heat or cold, the said paper being non heat-conducting.

SETTING BOILERS.—Charles Neames, New Orleans, La.—This invention relates to improvements in setting cylindrical or flue boilers, and has for its object to provide for consuming the smoke and gases more effectually than is now done. It consists in an arrangement of a deep chamber behind the bridge wall at the rear of the fireplace, into which a supply of fresh air is conducted below the grate, and to which the gases are conducted by a downward sloping arch, surrounding the boiler, over the said chamber, so that the said gases are prevented from coming in contact with the boiler before being sufficiently heated, and are brought into the presence of a sufficient quantity of oxygen to make the most perfect combustion.

SULKY PLOW.—Milo A. Elliott, Stratford Hollow, N. H.—This invention has for its object to furnish an improved sulky plow, simple in construction, easily operated, and effective in operation, being so constructed that it may be readily adjusted to cut a deep, shallow, wide, or narrow furrow.

PLOW.—Andrew Day, Crystal Springs, Miss.—This invention has for its object to furnish an improved plow, simple in construction, and effective in operation, and which shall have an adjustable scraper connected with it.

ADJUSTABLE COAT PATTERN.—George P. Sweezy, Riverhead, N. Y.—This invention has for its object to furnish a coat pattern which may be placed upon and adjusted to the form of each customer, so that any size coat may be cut, and cut to fit perfectly, with scarcely the possibility of mistake.

BUTTER PRINTER.—W. C. Stern and James W. Robinson, London Grove, Pa.—This invention relates to a new and useful improvement in a machine for printing butter in the process of preparing it for market.

MILL GEARING.—Henry Shoemaker and John A. McClintock, Perry, Ill.—The object of this invention is to provide convenient and efficient means for starting and stopping the burr stones of flour mills, without stopping or retarding the propelling power, and it consists, first, in a mechanism for throwing the spindle pinion out of and into gear with the spur driving wheel, and fixing it in position; secondly, in the use of a coil spring in the pinion, by means of which the inertia of the burr is overcome, so that the gearing revolves smoothly and without jerk or concussion; and, thirdly in the mode of revolving the pinion without driving the burr or spindle.

SAFE LOCK.—Crydon F. Atwood, Hancock, Wis.—This invention has for its object to construct a safe lock, which will be absolutely safe against false keys, and which, in fact, cannot be opened by any key, being locked by clockwork that is concealed within the safe. No keyhole or knob will therefore enable burglars to apply their tools with a view of opening the lock. The invention consists chiefly in the application to the safe of a concealed clockwork, which serves to withdraw the bolt at any time to which it may have been set.

LINIMENT.—James C. Branch and Hugh P. Quinn, Washington, Ga.—This invention relates to a new and useful improvement in a liniment for curing rheumatism, neuralgia, and similar diseases.

COMPOSITION FOR LIQUID GLUE.—William Horwitz, New York city.—This invention relates to a new composition for a liquid adhesive material, which is not liable to ferment or congeal when prepared, and which will be insoluble in water after application.

OPERATING PLOWS.—James O. Potter, Rouseville, Pa.—The object of this invention is to provide means for operating plows with less manual labor than is now required, and for keeping the plow more steady and regular in its movements in the ground than by the ordinary mode.

HYDRAULIC APPARATUS.—Nicholas Nolan, New York city.—The object of this invention is to provide means for elevating without additional power, water, or other liquid, to a hight greater than that at which it has its original level.

Electro-Magnetic Lock.—Henry Arden, St. Louis, Mo.—This invention has for its object to so construct a lock for safes, vaults, etc., that the same may be operated entirely by means of electricity, so that no keyhole need be provided in the safe door, nor any register on the safe, whereby the bolt may be withdrawn. A safe provided with an operating lock of this invention was exhibited in the recent American Institute Fair.

Ash Sifter.—W. S. Esty and I. S. Clough, New York city.—This invention consists of a simple and inexpressive device for separating the coal from ashes, and also flour, grains, and other materials, from impurities. The simplicity, cheapness, and efficiency of the machine recommend its extensive adoption. Mr. Clough is prepared to furnish the machine and dispose of rights at 63 Fulton St.

Spring Bed Bottom.—Thomas A. Carl, Nashville, Tenn.—This invention relates to a new bed bottom, which is supported by spring bars, made vertically adjustable along the inner faces of the side rails.

Medium for Turning Music Sheets.—Albert Kraft, Berlin, Prussia.—This invention relates to a new and useful improvement in a device for turning the sheets or leaves of music, when performing on a piano or other musical instrument, and it consists in so operating metallic fingers that the performer can, by simply pressing on a knob with the foot, cause the finger to turn the sheet or page of music to the end of the piece.

Water Wheel.—F. G. Coggin, Burlington, Vt.—This invention relates to a new chute mechanism for water wheels in which the chutes are made movoble by being cast or secured to movable rings, acd connected with gates that are pivoted to the stationary wheel case in such manner that by the movement of said movable rings the chutes and gates are adjusted simultaneously to more or less open the water veins, and consequently regulate the flow of water through the wheel.

Dumping Cars and Carts.—S. D. King, Middletown, N. Y.—The object of this invention is to so construct a dumping car or cart that the tail board need not be taken off for every operation of dumping, but may be removed when required.

Composition for Pencils.—William Geller, New York city.—This invention relates to a novel composition for pencils or marking instruments, and consists in the use of potato pulp for that purpose.

Box or Barrel Scraper.—F. B. Hill, East New York, N. Y.—This invention has for its object to furnish an improved tool for scraping the ends of barrels and the sides of boxes, to remove an old direction or mark, and prepare them to receive a new one.

Machine for and Process of Scouring the Eyes of Needles.—H. A. Nettleton and E. R. Lawton, West Cheshire, Conn.—This invention has for its object to facilitate the scouring or "threading" of the eyes of sewing machine and other sewing needles, and consists chiefly in the application of a movable scouring thread whereby the desired effect is rapidly produced.

Parlor or Roller Skates.—T. F. Leak, Montgomery, Ala.—This invention has for its object to furnish an improved parlor or roller skate which shall be simple in construction and reliable in use, being so constructed that the wood of the skate may rock upon the roller frames to enable the said wood to accommodate itself to the necessary movements of the foot.

Saw Mill Head Block.—B. F. Richardson and D. Richardson, Martinsburgh, Iowa.—This invention relates to a new and useful improvement in machinery for sawing lumber, having especial reference to the mode of handling and supporting the log, and it consists in a separate carriage or chair for each head block which may be moved either simultaneously or independently of the other, and in the mode of setting and dogging the log.

Composition for Coating Bearings, etc.—P. J. Kelly, New York city.—This invention relates to a new compound for covering soft material, such as leather, paper, etc., to prepare the same as a bearing or step for shafting and axles of suitable kind. The compound is metallic, and serves to utilize fibrous substances for bearings, and to cause a reduction of friction, as the soft bearing will be more yielding than the hard metallic bearings heretofore in use.

Scroll Sawing Machine.—A. M. Schilling, Chicago, Ill.—This invention has for its object to improve the construction of my improved scroll-sawing machine, patented March 30, 1869, and numbered 88,417, so as to make it more durable, more effective in operation, and more convenient in use.

Thimble Skein and Box for Wheeled Vehicles.—Thomas Smart, Jr., Brockville, Canada.—This invention relates to a new self-lubricating axle-box or thimble skein for wheeled vehicles, and consists in such a construction of the skein and box that the lubricating material will by the box be distributed transversely and on the skein longitudinally, so as to be brought in contact with every portion of the surface to be lubricated.

Combined Pin-Cushion Advertiser and Calendar.—Marcus Ormsbee, Brooklyn, N. Y.—This invention consists in a pin-cushion advertiser or picture ca and calendar combined and arranged in a small, light, and compact disk-shaped article suitable for carrying in the pocket without inconvenience.

Bee Hive.—J. A. Douglass, Altoona, Pa.—This invention relates to improvements in bee hives,and consists of two boxes and a slide arranged together in a peculiar way for transferring the bees from one to another.

Iron Block Lining for Fire Pots.—Edward A. Tuttle, Williamsburgh, N. Y.—This invention has for its object to furnish improved iron blocks for lining the fire pots of stoves, heaters, furnaces, etc.

Well Boring Apparatus.—Noah H. Lindley, Bridgeport, Conn.—This invention has for its object to furnish an improved apparatus for boring or digging wells, which shall be simple in construction, and effective in operation, cutting out and raising the dirt with dispatch, while, at the same time, leaving the inner surface of the bore or cut straight and smooth.

Fence.—U. D. Mihills, Fond du Lac, Wis.—This invention has for its object to furnish an improved fence, simple and cheap in construction, strong and durable, and not liable to sag, or to be blown or pushed over.

Deep-Well Pumps.—Martin Van Buren Rowley, Worcester, N. Y.—This invention has for its object to furnish an improved pump designed for use in deep wells and other situations where water is required to be raised to a greater hight than it can be by pumps constructed in the ordinary manner.

Oyster Dredge Winder.—Charles T. Belbin, Baltimore, Md.—The object of this invention is to prevent the windlasses, used on board of vessels under way (for the purpose of hoisting oyster dredges), from being suddenly and violently reversed, to the great danger of the men and the machinery, in case of the dredge accidently catching upon a rock or other unmovable obstacle. To this end, it consists in winding the dredge-rope or chain upon a spool upon the windlass, which is ordinarily prevented from turning on the shaft, when the latter is moving in the right direction, by means of a clutch, but is instantly released automatically from the clutch the moment the windlass turns backwards.

Cotton Scraper and Chopper.—Nathan M. Hale, Cleborne, Texas.—This invention consists in the combination of a pair of plows, placed just far enough apart to run one at each side of a row of cotton plants and close to the same, for the purpose of laying them bare of dirt; with a hoe placed in rear of the said plows for chopping the row transversely into stands; and with a second pair of plows placed in rear of the hoe, and arranged so as to throw dirt towards the plants from each side in order to form a ridge, the said hoe being combined with a mechanism which operates it as the plow is drawn along.

Horse Powers.—Rufus W. Crouse, Westminster, Md.—This invention is an improvement on that for which letters patent, No. 95,440, dated October 5, 1869, were issued to Diffendal and Hughes. The invention consists in a tumbling shaft extending entirely across the space beneath the main driving pinion, and bearing a coupling box at both ends so that connection may be made at either extremity; and a bevel pinion placed on the tumbing-shaft in such connection with the main driving pinion, as to receive motion in the right direction when the horses are traveling with the sun

Gang Plow.—William Mason, Independence, Oregon.—This invention relates to an improvement on the plow, for which letters patent of the United States were granted Wm. Mason, January 12, 1869, and is designed to simplify the construction of the same so as to reduce its weight and cost, and increase its efficiency.

Preserving Wood.—F. Lear, St. Louis, Mo.—This invention consists in a simple, strong, portable, and convenient apparatus, adapted to permit the ready insertion and removal of the log or other piece of timber, whether straight or crooked. The construction is such as to insure the permeation by the preserving liquid of the sound as well as of the unsound or less dense portions of the timber, and that without employment of extra or additional devices.

Door Bolt and Handle.—A. A. Stuart, Plainfield, Iowa.—This invention relates to a new mechanism for locking and unlocking doors, and consists chiefly in the use of a bow-shaped handle, which is provided with a sliding wedge, whereby the bolt can be opened.

Device for Unloading Wagons.—Isaac Williams, Westfield, Ind.—This invention relates to a new attachment to farmers' wagons, and has for its object to facilitate the unloading of the same, and to enable persons unloading to immediately make use of their scoops.

Channel Laying Machine.—Seth D. Tripp, Lynn, Mass.—This invention relates to improvements in machinery foa the manufacture of boots and shoes, and consists in a combination with a last, or former, for holding the boot or shoe of rubbing or smoothing belts, rollers, or screws, arranged to so act upon the soles of the boots or shoes as to lay the ridge of leather raised in forming the channel in which the stitching or pegging for attaching the sole is done back into the channel and smoothing it down.

Bed Springs.—D'Alembert T. Gale, Fort Wayne, Ind.—This invention relates to an improved manner of connecting the top and bottom coils of coiled bed springs, and it consists in an arrangement of loops or eyes in one end coil and hooks in the other, and the hooking of the same together.

Fastening for Clothes.—Frank M. La Boiteaux, College Hill, Ohio.—This invention relates to improvements in buttons or fastenings for clothes, and consists in a button of any form or size, having a small stem projecting from the center in which a slot is made on the outer end, and hook-shaped notches in the walls of the slats, which will admit of turning the said stem a quarter of a revolution, after passing into an eyelet having a cross-bar so arranged as to be received in the said slot, the said notches thus engaging the said bar and holding the button to prevent it being drawn out; the stem is passed through a small hole in the part of the cloth to which the button is to be attached, and screws into the button; the eyelet is placed in one part of the cloth to be buttoned, and the stem of the button is passed through the other into the eyelet.

Official List of Patents.

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Patent Solicitors, No. 37 Park Row, New York.

108,951.—Pad and Trunk Lock.—A. M. Adams, Washington, D. C.
108,952.—Electro-Magnetic Lock.—Henry Arden, St. Louis, Mo.
108,953.—Fanning Mill.—H. K. Averill, New Oregon, Iowa.
108,954.—Pump.—W. C. Barker, Ypsilanti, Mich.
108,955.—Gearing for Metal Planers.—W. M. Barr, Williamsport, Pa. Antedated October 28, 1870.
108,956.—Head Rest.—J. S. Bartlett, Warsaw, N. Y.
108,957.—Compound for Pipes, Tiles, Sidewalks, etc.—W. A. Battersby, Williamsburgh, N. Y., assignor to himself, T. H. Crawford, Robert Brown, and John Anderson.
103,958.—Spark-Catcher and Consumer.—Darwin Beach, Oshkosh, Wis.
108,959.—Sucker-Rod Coupling.—J. H. Beatty, Franklin, assignor to John Adams and T. W. Brigham, Venango county, Pa.
108,960.—Bee Hive.—Joseph Behe, Carrollton, Pa.
108,961.—Hat and Coat-Rack.—G. T. Benson, Jersey City, N. J.
108,962.—Ore Washer.—Hezekiah Bradford, Reading, Pa. Antedated October 28, 1870.
108,963.—Liniment.—J. C. Branch and H. P. Quin, Washington, Ga.
108,964.—Permutation Lock.—F. H. Brown (assignor to himself and B. J. Wiley), Chicago, Ill. Antedated November 5, 1870.
108,965.—Apparatus for Cooling the Vapors of Oxide of Zinc.—J. E. Burrows, Newark. N. J.
108,966.—Spring Bed Bottom.—T. A. Carl, Nashville, Tenn.
108,967.—Steering Mechanism for Velocipede.—Andrew Christian, New York city.
108,968.—Sash Holder.—C. B. Clark, Buffalo, N. Y.
108,969.—Churn.—Timothy Coffield and Benedic Egli, Natrona, Pa.
108,970.—Water Wheel.—F. G. Coggin, Burlington, Vt.
108,971.—Gate Latch.—Calvin Cole, Ithaca, N. Y.
108,972.—Shade for Lamp and Gas Burners.—M. H. Collins, Chelsea, Mass.
108,973.—Folding Chair.—T. B. Comins, Jr., Lowell, Mass.
108,974.—Straw Cutter.—E. A. Cralle, Jr., Brickland, Va.
108,975.—Plow.—R. S. Crockett, Rossville, S. C.
108,976.—Portable Elevator and Conveyor.—H. C. Crosby, Chicago, Ill.
108,977.—Device for Keying Paving Blocks.—P. D. Cummings, Portland, Me.
108,978.—Steam Radiator.—L. S. Daniels, Foxborough, Mass.
108,979.—Plow.—Andrew Day, Crystal Springs, Miss.
108,980.—Type-Setting Machine.—Manoel de la Pena (assignor to J. G. O. Guimaraes), New York city.
108,981.—Saw Mill.—Moses Delude, Carrolton, Mich.
108,982.—Valve Gear for Steam Engine.—W. B. Doddridge, Hebron, Ind.
108,983.—Preserving Meat, Fish, Oysters, etc.—J. E. Dotch, Washington, D. C. Antedated October 29, 1870.
108,984.—Bee Hive.—J. A. Douglass, Altoona, Pa.
108,985.—Insole for Manufacturing Shoes.—C. S. Dunbrack, Swampscott, Mass. Antedated November 7, 1870.
108,986.—Screw Spike for Railroads.—A. C. Dunn and I. L. Dunn, New York city. Antedated October 28, 1870.
108,987.—Lock Nut.—Philip Dyer, Jr., Abram Parker, and W. B. Way, Pontiac, Mich.
108,988.—Seed Planter.—J. M. Elliott, Winnsborough, S. C.
108,989.—Lunch Box.—James Elson, Northampton, Mass.
108,990.—Blank for Saw Teeth.—J. E. Emerson, Trenton N. J.
108,991.—Ash Sifter.—W. S. Esty and I. S. Clough, Brooklyn, N. Y.
108,992.—Wood-Bending Machine.—Joshua Fipps, New Albany, Ind.
108,993.—Children's Carriage.—I. N. Forrester, Bridgeport, Conn.
108,994.—Window Sash Weight.—J. T. Foster, Jersey city, N. J., assignor to William Stanley, Englewood, N. J.
108,995.—Horse Collar Pad.—John Fraser, Dowagiac, Mich.
108,996.—Attachment of Cultivator Frames to Wagon Axle-Trees.—David Fuller, Fullersburg, Ill.
108,997.—Bee Hive.—G. G. Gabrion, Olive, Mich. Antedated October 26, 1870.
108,998.—Bed Spring.—D. T. Gale, Fort Wayne, Ind.
108,999.—Piston Packing.—John Gates, Portland, Oregon.
109,000.—Composition for Pencils.—William Geller, New York city.
109,001.—Laterally Sliding Throttle Valve.—William Glass, Brooklyn, N. Y.
109,002.—Roofing Composition.—J. P. Godfrey, Manchester, N. H.
109,003.—Reed Organ.—H. N. Goodwin, Syracuse, N. Y.
109,004.—Steam Trap.—M. C. Gove, Lowell, Mass.
109,005.—Lath Machine.—J. T. Hall (assignor to himself and Isaac Pierce), Alma, Mich.
109,006.—Pendulum Crushing Mill.—James Hart, Sweeden Center, N. Y.
109,007.—Awning.—William Hildebrand, Fort Wayne, Ind.
109,008.—Box Scraper.—F. B. Hill, East New York, N. Y.
109,009.—Preparation of Peat.—C. E. L. Holmes, New York city.
109,010.—Liquid Glue.—William Horwitz, New York city. Antedated October 28, 1870.
109,011.—Rocker-Chair.—C. H. Hudson and Joel Bowker, New York city, assignors to C. H. Hudson.
109,012.—Extension Scaffold.—John Hughes, New Berne, N. C.
109,013.—Governor for Steam Engine.—R. K. Huntoon Wakefield, assignor to J. A. Lynch, Boston, Mass.
109,014.—Fire-Cracker Pistol or Holder.—Robert Hutchison, Newark, N. J.
109,015.—Machine for Extracting Stumps.—J. A. Jenkins Clarksville, Mo.
109,016.—Spinning Wheel.—Thomas Johnson, Ruby Post Office, assignor to himself and George Adams, Watrousville, Mich.
109,017.—Coat and Hat Rack.—James M. Keep, New York city.
109,018.—Composition for Coating Bearings.—P. J. Kelley, New York city.
109,019.—Digging Machine for Agricultural Purposes.—A. L. Kennedy, Philadelphia, Pa. Antedated October 29, 1870.
109,020.—Dumping-Car.—S. D. King, Middletown, N. Y., assignor to himself and J. M. Welch, Bradford, Pa.
109,021.—Flux for Working Metals and Minerals.—Solomon W. Kirk (assignor to himself and Henry Thomas), Philadelphia, Pa.
109,022.—Fireplace Stove.—Philip Klotz, Baltimore, Md.
109,023.—Medium for Turning Music Sheets.—Albert Kraft, Berlin, Prussia, assignor to F. G. Utassy & Co., New York city.
109,024.—Button-Fastener.—F. M. La Boiteaux, College Hill, Ohio.
109,025.—Removing Dies made from Aniline, etc., from Portions of Fabrics.—Jean Lambert, Jr. (assignor to Gustave Bourgade), New York city.
109,026.—Parlor Skate.—Tilman F. Leak, Montgomery, Ala.
109,027.—Coloring and Preserving Wood.—Frederick Lear, St. Louis, Mo.
109,028.—Well-Boring Apparatus.—N. H. Lindley, Bridgeport, Conn.
109,029.—Double and Single-tree Attachment for Street Car.—J. F. Lowe, Louisville, Ky.
109,030.—Washing and Transporting Sand.—David D. Mallory, Mystic Bridge, Conn.
109,031.—Device for Fastening Desks, Seats, etc., to Floors.—John D. McAuliff, St. Louis, Mo. Antedated October 28, 1870.
109,032.—Horse Hay Fork.—W. W. McFaddin, Ennisville, Pa.
109,033.—Spring for Wagon.—A. W. McKown, Honesdale, Pa.
109,034.—Brick Machine.—William Mendham and Cyrus Chambers, Jr. (assignors to Edwin Chambers and Cyrus Chambers, Jr.), Philadelphia, Pa.
109,035.—Animal Trap.—John B. Merriman and George B. Lewis, Plantsville, Conn.; said Lewis assigns his right to said Merriman.
109,036.—Fence.—Uriah D. Mihills, Fond Du Lac, Wis.
109,037.—Plane.—Ellis H. Morris, Salem, Ohio.
109,038.—Tool Handle.—Edgar Murray, New York city, assignor to C. W. Dunlap, Brooklyn, N. Y.
109,039.—Setting Boiler.—Charles Neames, New Orleans, La.
109,040.—Machine for Scouring the Eyes of Needles.—H. A. Nettleton and E. R. Lawton, West Cheshire, Conn.
109,041.—Combined Barrow and Turnip Drill.—A. M. Newland, Olivet, Mich.
109,042.—Hydraulic Apparatus.—Nicholas Nolan, New York city. Antedated October 29, 1870.
109,043.—Stove-Pipe Grate.—Joseph O'Malley, Montreal, Canada.
109,044.—Pin Cushion.—Marcus Ormsbee, Brooklyn, N. Y.
109,045.—Apparatus for Towing Canal Boats.—S. W. Palmer and J. F. Palmer, Auburn, N. Y.
109,046.—Machine for Dressing Millstone.—James Pepler, Bath, England. Antedated October 29, 1870.
109,047.—Pitmen.—C. H. Perkins (assignor to Perkins Sheet-Iron Co.), Providence, R. I.
109,048.—Device for Operating Plows.—James O. Potter, Rouseville, Pa.
109,049.—Top of Gas and Water Stop-Cock Boxes.—W. W. Pullis (assignor to Thomas R. Pullis and John Pullis), St. Louis Mo.
109,050.—Portable Cradle or Crib.—D. M. Reynolds, Chicago, Ill.
109,051.—Table.—D. M. Reynolds, Chicago, Ill.
109,052.—Sawmill.—B. F. Richardson and David Richardson Martinsburg, Iowa.
109,053.—Balance Slide Valve.—A. K. Rider (assignor to himself, Cornelius H. Delamater, and George H. Reynolds), York N. Y.
109,054.—Lamp-Heating Apparatus.—Alvah Rittenhouse Philadelphia, Pa.
109,055.—Horseshoes.—John S. Robertson, Wood End, near Cathcart, Scotland.
109,055.—Ventilator.—William F. Ross, Davenport, Iowa.
109,057.—Pump.—Martin Van Buren Rowley, Worcester, N. Y.
199,058.—Stool and Traveling-Bag.—John Salisbury and Benjamin Wilbur, Scituate, R. I. Antedated October 26, 1870.
109,059.—Dye Tub.—Thomas Sampson, Providence, R. I.
109,060.—Scroll Saw.—August M. Schilling, Chicago, Ill.
109,061.—Churn Dasher.—Levi Scott, Burgettstown, Pa.
109,062.—Harvester.—Allen Sherwood and Clarence Sherwood, Auburn, N. Y.
109,063.—Mill Gearing.—Henry Shoemaker and J. A. McClintock, Perry, Ill.
109,064.—Metallurgic Gas Furnace.—C. W. Siemens, Westminster, England.
109,065.—Method of Cutting Boot Packs.—W. G. Slater, Hart, Mich.
109,066.—Thimble-Skein and Box for Vehicles.—Thomas Smart, Jr., Brockville, Canada, assignor to himself and Edward Smart, Pittsburgh, Pa.
109,067.—Sewer Catch-basin Cover.—Henry Smith, Jr., Milwaukee, Wis.
109,068.—Drying and Preserving Apples.—M. P. Smith, Baltimore, Md.
109,069.—Chain Water Wheel.—W. M. Starr, Washington, D. C.
109,070.—Butter Printer.—W. C. Stern and J. W. Robinson, London Grove, Pa.

109,071.—Barrel Filler.—Frederick Stitzel, Louisville, Ky.
109,072.—Hat Finishing Machine.—G. W. Stout, Newark, N. J., assignor to New York Hat Finishing Co.
109,073.—Corner Trowel.—Sumner F. Streeter, Bernardston, Mass.
109,074.—Latch.—A. A. Stuart (assignor to himself and J. D. Eddy), Plainville, Iowa.
109,075.—Relishing Machine for Tenoning Sash.—George L. Sullivan and Edward Lippincott, Chicago, Ill. Antedated October 29, 1870.
109,076.—Adjustable Coat Pattern.—G. P. Sweezy, Riverhead, N. Y.
109,977.—Machine for Laying Channels in Boots and Shoes.—Seth D. Tripp, Lynn, Mass.
109,078.—Boring Machine.—Andrew J. Truxell, Lynchburg, Va.
109,079.—Combined Center and Lathe Dog.—A. J. Trixel, Lynchburg, Va.
109,080.—Iron Lining for Fire Pot.—E. A. Tuttle, Williamsburgh, N. Y.
109,081.—Cook Room Refrigerator and Condenser.—P. Van Deventer, Wright City, Mo.
109,082.—Cultivator Rake.—James T. Van Wyck, Poughkeepsie, N. Y.
109,083.—Floating Velocipede.—C. O. Wederkinch and Archibald Starkweather, Boston, Mass.
109,084.—Brush.—J. L. Whiting, Boston, Mass.
109,085.—Paper File.—F. W. Whitney, Brooklyn, N. Y.
109,086.—Steam Gage and Safety Valve.—I. N. Whittlesey, Mount Vernon, Ind.
109,087.—Curtain Fixture.—John H. Wilhelm, Chicago, Ill.
109,088.—Device for Unloading Wagons.—Isaac Williams, Westfield, Ind.
109,089.—Brick Machine.—John R. Williams, Taunton, Mass.
109,090.—Pot for Glue, Paint, etc.—John J. Wilson, New York city.
109,091.—Ditching and Grading Machine.—H. A. Winter, Windsor, Ill.
109,092.—Machine for Booking Tobacco Leaves.—Joseph Wise, Elizabeth, N. J. Antedated Oct. 22, 1870.
109,093.—Potato Digger.—Albert R. Wixom, Farmington, Mich.
109,094.—Machine for Bending Iron Pipe for Welding.—E. G. Woodworth, John Brawdy, and Fitch Merithew, Birmingham, Pa. Antedated Oct. 29, 1870.
109,095.—Spring for Vehicles.—Enos Wright, Lee county, Iowa.
109,096.—Door Check.—Charles P. Young, Attleborough, Mass.
109,097.—Self-acting Wagon Brake.—Anthony Zink, Lancaster, Ohio.
109,098.—Tree Protector.—Abraham S. Adams, Waynesborough, Pa.
109,099.—Water Wheel.—Benj. J. Barber, Ballston Spa, N. Y.
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109,163.—Mechanical Movement.—John H. Whitney, Rochester, Minn.
109,164.—Stop-motion Gear Wheel.—John H. Whitney, Rochester, Minn.
109,165.—Swing.—Lucius Winston, Pontiac, Ill.

REISSUES.

4,174.—Machine for Husking Corn.—L. A. Aspinwall, Albany, N. Y.—Patent No. 101,809, dated April 12, 1870; reissue No. 4,090, dated August 16, 1870.
4,175.—Heating Stove.—S. H. La Rue, Allentown, Pa.—Patent No. 105,816, dated July 26, 1870.
4,176.—Drip Filtering Oil Fountain.—Eli F. Wilder, Lowell, Mass.—Patent No. 101,069, dated March 22, 1870; antedated September 22, 1869.

DESIGNS.

4,457.—Ornamentation of Glassware.—J. S. Atterbury and T. B. Atterbury, Pittsburgh, Pa.
4,458.—Buckle.—J. I. Bell, Bell's Bridge, Cal.
4,459.—Watch Plate.—F. A. Jones, Boston, Mass.
4,460.—Box for the Top of Bureaus.—Cheney Kilburn assignor to Kilburn & Gates), Philadelphia, Pa.
4,461.—Rustic Fence.—John Millar, Paterson, N. J.
4,462.—Picture Frame.—Joseph H. Saunders, Johnson, R. I.
4,463.—Toaster and Broiler.—P. B. Sheldon, Rochester, N. Y.
4,464.—Range or Stove.—Nicholas S. Vedder, Troy, and Tobias S. Heister, Lansingburgh, N. Y., assignors to J. L. Mott, New York city.

TRADE-MARKS.

53 to 55.—White Lead.—Brooklyn White Lead Company, New York city. Three Patents.
56.—Cosmoline—A Product of Petroleum.—Edwin F. Houghton, Philadelphia, Pa.
57.—Table Sauce.—William King, Springfield, Ill.
58.—Preparation for the Hair.—J. L. Martin, Baltimore, Md.
59.—Soap.—Alexander Warfield, Philadelphia, Pa.
60.—Superphosphate.—Wattson & Clark, Philadelphia, Pa.

EXTENSIONS.

Smut Machines.—Harvey B. Ingham, of Camptown, Pa.—Letters Patent No. 15,978, dated October 28, 1856; Antedated June 24, 1856.

Cider Mill.—T. K. Kinderberger, Eaton, Ohio.—Letters Patent No. 12,928 dated May 29, 1855; reissue No. 2,332, dated August 14, 1866.

According to the "Commissioners of Patents' Journal," dated October 14, from which the subjoined list was compiled, of the seventy-three new inventions for which British Provisional Protection was granted, seventeen came from this side of the Atlantic. We have repeatedly urged upon American inventors the expediency of patenting their inventions abroad, and are glad to notice that so many are availing themselves of our advice. We would again call the attention of inventors to the fact that, while it is comparatively easy to obtain letters patent in England, it is quite another matter and one that requires not only skill and care, but also an intimate acquaintance with the progress of the arts and foreign patent law and practice, to so draw up the necessary papers that the rights of the inventor may be secured, should the validity of the patent become a subject of litigation.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,536.—Heels for Boots and Shoes.—H. H. Bigelow, Worcester, Mass. September 21, 1870.

2,541.—Sharpening and Polishing Sewing Machine Needles.—E. E. Blyth, Rochester, N. Y. September 21, 1870.

2,560.—Rasps and Files.—Franklin Thompson, Boston, Mass. September 23, 1870.

2,562.—Printing Type.—J. W. Wright, Montreal, Canada. September 24, 1870.

2,572.—Machinery for Twisting and Laying Cords and Ropes.—H. Perkins, Mansfield, Mass. September 27, 1870.

2,574.—Breech-loading Firearms.—Olof Nilson, Red Wing, Minn. Sept. 28, 1870.

2,576.—Apparatus for Supplying Paper to Printing Presses.—Olof Nelson, Red Wing, Minn. September 29, 1870.

2,578.—Electro-Magnets.—E. W. Andrews, Englewood, N. J. Sept. 28, 1870.

2,596.—Valve Apparatus for Vessels for containing Petroleum, and other Volatile Oils and Spirits.—Meissner, Ackermann & Co., New York city. September 30, 1870.

2,608.—Apparatus for Utilizing the Power and Heat of the Steam used in Motive-power Engines, and for other Purposes.—T. T. Prosser, Chicago, Ill. October 1, 1870.

2,611.—Fixed Ammunition for Firearms and Tools for Manufacturing it.—T. J. Powers, New York city. October 1, 1870.

2,624.—Machinery and Apparatus for Transmitting Passengers, Goods, etc.—M. Cooper, Buenos Ayres, South America. October 3, 1870.

2,628.—Forming Threads in Metallic Nuts.—B. Howard, Paola, Kansas, and E. Fitch, Ravenna, Ohio. October 3, 1870.

2,634.—Chamber Utensil.—V. Rhodes, Memphis, Tennessee. October 4, 1870.

2,652.—Spring Weighing Scales.—J. V. Mathivet, Cleveland, Ohio. October 5, 1870.

2,660.—Instruments for Obtaining Solar Measurements of Latitude and Longitude.—L. I. Trueg, Saint Vincents, Pa. October 7, 1870.

2,678.—Steam Engines.—John Houpt, Springtown, Pa. October 10, 1870.

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